The OIL AND GAS JOURNAL

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16-PAGE SPECIAL REPORT

REFINERY INSTRUMENTATION AND CONTROL

- Process-stream monitoring
- Closed-loop computer control

p. 127

Climate outlook for mergers: Colder p. 97

Jet-fuel demand to top early predictions p. 102

Port Acres: Hot spot in small-tract war p. 108

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Acidizing? Fracturing? Waterflooding?

GET HIGHER INJECTION RATES with LOWER PUMP PRESSURES

Case History No. 1

Area – West Texas
Formation – Ellenberger Dolomite
Depth – Below 12,000'

BEFORE VIBRO-FRAC, acidizing injection rate averaged .15 bbls. per minute at 6500 p.s.i.

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Case History No. 2

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Formation – Devonian Chert
Depth – Below 8,500'

BEFORE VIBRO-FRAC, this formation would not take acid in offset wells.

The twelve foot zone of interest was perforated with 72 E-Gun holes and three VIBRO-PERFORATOR shots. Three casing type VIBRO-FRAC charges were spaced in the twelve foot zone.

AFTER VIBRO-FRAC, formation took acid at the rate of 2.4 bbls. per minute at 1500 p.s.i.

Acidizing a formation can mean the difference between a commercial producer and a dry hole. But how do you acidize a formation that won't take acid?

Many formations require extremely high pump pressures. Some formations won't break down at all. For these wells pre-treatment with VIBRO-FRAC, Lane-Wells explosive well stimulation service, makes acidizing practical. Selective fracturing produced by VIBRO-FRAC treatment opens up the formation — lets the acid in to do its work.

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OIL AND GAS JOURNAL
Vol. 57 No. 41

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SPECIAL REPORT: REFINERY INSTRUMENTATION AND CONTROL 127

Edited by Gerald L. Farrar

1. What's New in Continuous-Stream Monitors 127

Status Report: Sun's Product-Control Center 128

By Paul D. Barton

A three-room air-conditioned building has been completed and equipment is now being installed at Sun's Marcus Hook refinery. The center will use process stream monitors and computers to improve the quality of information on which plant operations are based. The test will be carried out on a 60,000-bbl. per day combination unit.

Analyzers Supply Continuous E.P.-I.B.P. Data 130

By D. H. Stormont

Initial boiling points and end points of many refined products are being continuously and accurately determined by a West Coast refiner. Output is recorded and an operator manually adjusts quality and production.

Process Monitors Work for Other Properties, Too 132

Other monitors which have been developed recently include instruments for determining viscosity, vapor pressure, boiling point, flash point, color, and analysis for sulfur.

Gas Chromatography Scores in Stream Analysis 135

Chromatography Monitors Four Refinery Fractionating Columns 135

By R. C. Halter and L. W. Pohler

A plant-type chromatographic analyzer is automatically analyzing in sequence samples from each of four plant towers at Humble's Baytown refinery.

2. Analog Computers Solve Many Control Problems 138

The analog instrument is well suited for local optimizing control, since it is simple, rugged, accurate, and reliable.

3. Digital Computers—Key to Plant Automation 140

Application of these units in closed-loop operation has now been made. This step should soon be possible for all except the most complicated process.

TECHNOLOGY—OPERATION

New Drilling Fluids Harden Shales 147

By W. J. Weiss, W. L. Hall, and R. H. Graves

Shale-control muds have been used to drill more than 1,000 wells covering almost every drilling condition in the United States and in many other areas.

New Mexico Shows Good Water-Flood Potential 156

By Kenneth L. Smith

Twelve Permian fields in southeastern New Mexico are now under active water-flood operation with more scheduled to come.

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By E. T. Guerrero and F. M. Stewart

How to determine effective permeability from pressure-buildup data under finite boundary conditions.

Guides for Computer Control of a Pipeline 172

By J. T. Manry III

Planning the steps to a given control level in phases may be the proper procedure. General use of the computer is helpful in planning an all-out system-computer-control plan.

Humble Attacks Pollution at Baytown—1 176

By Larry Resen

A multipronged attack on air and stream pollution has resulted in marked improvement. The project is continuing, even though progress in the past decade has been greater than called for by the original goals.

Iowa-Illinois Pipeline Is Laid in 9-Ft. of Mud 183

Special equipment was needed when Michigan-Wisconsin Pipe Line Co.'s looping program called for laying a section through river-bottom mud.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Oct. 5, 1959

New oil mergers are sure to face chilly reception:

The Government is getting tougher on all mergers.

Any new consolidations in oil are considered likely to get close attention of Justice Department or Federal Trade Commission.

This policy is revealed by Journal interview with chief antitruster in Washington. His aim is to keep oil industry from becoming dominated by giants as steel is (p. 97).

Under power it now has, Government can challenge mergers on nearly any point. Result: Any company now planning consolidation of any kind must weigh possibility of antitrust suits before making the move.

Real reason for Justice opposition to Texaco-Superior merger: It was just too big to let get by.

Two other big factors: Firms had many common crude purchasers. Some refiners who buy crude from Superior compete with Texaco. Justice felt the merger would have too great an impact on production and refining circles.

▼ ▼ ▼

Product markets remain too soft:

...Gasoline prices eased off another quarter cent in the Group 3 market last week with regular now going for 11c a gallon, and this may be shaded for volume. Local price wars continue in the Rockies. Gulf Coast postings also may be shaded a quarter cent for late October cargoes.

...Distillate fails to pick up demand. Suppliers may have difficulty returning to regular prices after allowing summer-fill discounts. Early cold weather is badly needed to help cut down the heavy stocks.

...Residual markets are softer in the Mid-Continent, but Gulf Coast prices are firm despite loss of steel markets.

Rays of hope: Buildup in product stocks is slowing down due to cuts in refinery runs and increased demand. The runs were trimmed in last 2 weeks of September to average of 7,858,000 bbl. daily, drop of 364,000 bbl. from average for preceding 4 weeks. Average increase in four-product stocks in last 2 weeks was only 639,000 bbl. weekly compared with weekly average of 6,900,000-bbl. buildup for 4 weeks earlier.

The inhibitor squeeze—a proven tool for reducing corrosion in sweet-crude wells—is now cutting corrosion in sour-crude areas.

The squeeze is applied by displacing an organic corrosion inhibitor out into the producing formation from the well bore. The inhibitor is adsorbed on the formation rock and is slowly returned to the well with produced fluids. This gives continuous treatment over an extended period of time.

Results from 11 applications in West Texas: Corrosion rate has been cut as much as 90%. Treatments involving two squeeze applications have been effective for more than year.

▼ ▼ ▼

Continent's most northerly wildcat may be drilled next summer.

Reports in Ottawa say Round Valley Oil of Calgary is considering moving a rig by air or sea to Cornwallis Island, about 1,700 miles north of Winnipeg and 800 miles from the North Pole.

Round Valley holds most of the Cornwallis acreage and has made geological studies of the island.

Scurry-Rainbow Oil is moving equipment inside Arctic Circle, 18 miles west of Mackenzie River. This will be Canada's most northerly wildcat until Cornwallis job starts.

Look for decided pickup in Ontario exploration.

Brisk leasing plays are going on throughout southwestern part of the province. These follow successes in ferreting out sharp-peaked reefs of the Silurian. Some operators call them upside-down ice cream cone reefs with small but prolific productive areas.

Ready markets nearby plus cheaper drilling are the magnets. Some Western Canadians are attracted after despairing of any near-term improvement in the Prairie market outlook.

▼ ▼ ▼

Wildcat to watch in northeastern Colorado is Kinney-Coastal-Ohio 1 Rockwell in Yuma County. Operators found oil shows in the Pennsylvanian.

Test is 15 miles northwest of Beecher Island gas field in easternmost edge of Denver basin. Strike would add zest to the big play in northwest Kansas and southwest Nebraska.

Wyoming wildcatting is showing results.

Green River basin has two important fields. Texas National Petroleum well at West Desert Springs tested gas shows 3 miles west of nearest production in the Almond Upper Cretaceous. El Paso Natural found gas at Patrick Draw.

Powder River basin's north side is in line for a new Pennsylvanian discovery. Champlin is testing its wildcat in Crook County, 7 miles northeast of Pennsylvanian Minnelusa production at Donkey Creek field.

Drilling notes: Oasis apparently has new wildcat strike in western Libya 250 miles southwest of Tripoli (p. 118)... Mobil and French firm have 340-bbl. daily discovery in Gabon on Africa west coast...Shell is putting two rigs to work in Maracaibo Blocks 7 and 8 drilling offsets to Block 17 field being developed by Phillips group...Superior plans to halt drilling its prolific Lama field in Maracaibo. No market for the oil...Mecom-Magnolia well in South Louisiana soon to spud will have projected depth of 26,000 ft., a record mark if reached (p. 101).

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First TV monitoring is planned for gas trunk-line operations.

The television test will be applied to one compressor station of a large transmission system originating from the Gulf Coast. If the idea proves suitable, TV monitors may be installed along the entire system.

Pipeline is being planned by Bolivia in effort to expand crude production and exports.

Government oil agency, YPFB, has in the works a 407-mile, 12-in. crude line from the Camiri producing area to Sica Sica. There it would connect with the recently completed 8 and 10-in. line to Arica on the Chilean Pacific Coast.

The 24-in. Hassi-Messaoud-Mediterranean pipeline burst in a number of places during latest hydrostatic tests. Whether fault is pipe defects or poor welding hasn't been determined. Official opening of line as a result has been delayed 2 months.

Pipelining notes: Transwestern may start its Texas-to-California gas line by Nov. 1 and make first delivery in June if other suppliers follow Gulf lead in committing their reserves (p. 101)...Syria is giving top priority to plans for local products pipeline system, is sidetracking idea for long crude line from its new field to the sea...California Standard is drawing plans for pipeline and tanker terminal at Nikiski on Alaska's Cook Inlet to handle crude from Swanson River.

▼ ▼ ▼

Another step toward the computer-controlled process plant has been taken by Phillips Petroleum.

Company's process-development division has designed and built an on-line analog computer for automatic control of a petrochemical reactor.

The instrument:

...Scans 14 process variables every 30 seconds and computes a heat balance around the reactor.

...Computes and reads out instantaneous concentration of product in the reactor.

...Achieves automatic control by manipulating one of the input variables to maintain a constant production rate.

The measurements of temperature, differential pressure, electrical power for mixing, and heat loss from the vessel come to the computer as direct-current electrical signals.

Jet-fuel demand will grow faster than expected.

Total domestic demand will reach 500,000 bbl.daily by 1964 compared with present 300,000 bbl. daily.

Reasons: Commercial jets and turboprops are coming into service faster than expected...Government's economy drive on military requirements has not cut as deep as expected (p. 102).

Polypropylene market may hit billion pounds by 1965.

This bullish outlook comes from Paul Mayfield of Hercules Powder Co., whose market studies indicate this annual volume will be reached within 6 years. Hercules is first U. S. firm to produce polypropylene commercially, starting up its Parlin, N. J., plant late in 1957.

By comparison, polyethylene, fastest growing of the petrochemicals currently, is expected to reach the billion-pound-per-year mark this year.

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Delinquency charges are being assessed by more and more oil firms on customer invoices for late payment of gasoline and heating-oil accounts.

Union Oil plans a 1% monthly charge on accounts 60 days or more past due...Continental has 1.5% monthly charge on its credit-card accounts 90 days or more overdue in its northern region...Atlantic Refining charges 1% on 60-day delinquencies.

Atlantic's move followed 2-year test in limited area. It showed 20% drop in delinquency first year and another 14% drop in second. Real eyeopener: Customers assessed the late charge continued to buy products at their normal rate.

Back of the charges are these trends: Gross bad debts on wholesale accounts and credit cards are at record highs.

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Look for pressure on Detroit to change design of carburetors and intake manifolds on automobile engines.

Radioactive studies by Ethyl Corp. show wide differences in distribution of fuel to various cylinders.

Unequal quantities and qualities mean some cylinders get over-rich conditions, others over-lean. Result is knocking and poor efficiencies.

Very low or very high volatility will aggravate conditions leading to maldistribution of the fuel among the cylinders. Some tailoring of current fuels would help, but modifications to the intake system would make the big difference.

Good Wells Make Good News

A Monthly Report on Wells That Are Now Worth More

October 5, 1959

Here are four recent examples of the many thousands of wells whose value has been increased with acid treatments performed by Dowell.

- Hot Springs County, Wyoming (New Oil Well) This well was completed into two sections of the dolomitic Madison lime. Perforations were from 4528 to 4558 feet, and from 4570 to 4584 feet. Since the lower section was more permeable, Dowell recommended acidizing it first and then plugging it off before acidizing the top zone. The bottom zone was treated with 750 gallons regular acid, tested at 16 boph, and temporarily plugged with 30 gallons of Jelly Seal. Then the upper zone was acidized with 3000 gallons acid with a demulsifying agent added. After clean-up the well tested 32 boph.

- McPherson County, Kansas (Water Injection Well) This well completed open hole into the Hunton lime would not take water at 500 psi. Dowell recommended a hot Stabilized Acid treatment using magnesium pellets as the heating agent. First, the zone was washed with 250 gallons of Mud Acid. Then 100 pounds of magnesium pellets were lubricated down tubing and filtered out on the formation face. 1000 gallons of Stabilized Acid were then injected slowly. One year later, the well was still taking more than 400 bwpd on vacuum.

- San Juan County, Utah (Old Oil Well) Production had declined to 200 bopd. Pay was the highly soluble Paradox between 5407 and 5581 feet. Dowell recommended a special acid treatment designed to establish a large drainage area throughout the pay. 40,000 gallons of Retarded Acid were injected in four 10,000-gallon stages. A total of 378 perforation ball sealers were used between stages. An injection rate of 25 bpm was maintained. After clean-up, well tested 700 bopd. Six months later it still tested 700 bopd.

- Cass County, East Texas (New Oil Well) The pay was a section of the Anhydrite between 6102 and 6111 feet. Potential was 80 bopd. Dowell recommended a three-stage treatment: First, 1000 gallons of acid with a silicate control agent added; then, 5000 gallons Retarded Acid with 18 perforation ball sealers; finally, 5000 more gallons acid with silicate control agent plus five more ball sealers. After clean-up, well tested 250 bopd.

Since well characteristics vary so widely, many operators find it pays to rely on Dowell's experience and engineering for the best possible results. For service or detailed information, contact the Dowell office or station nearest you. There are more than 165 locations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

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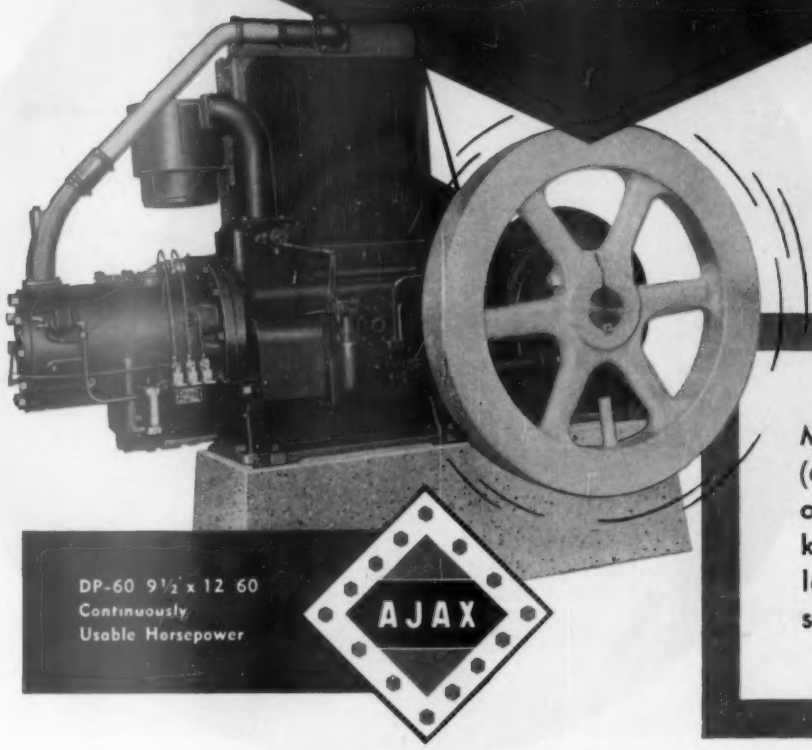

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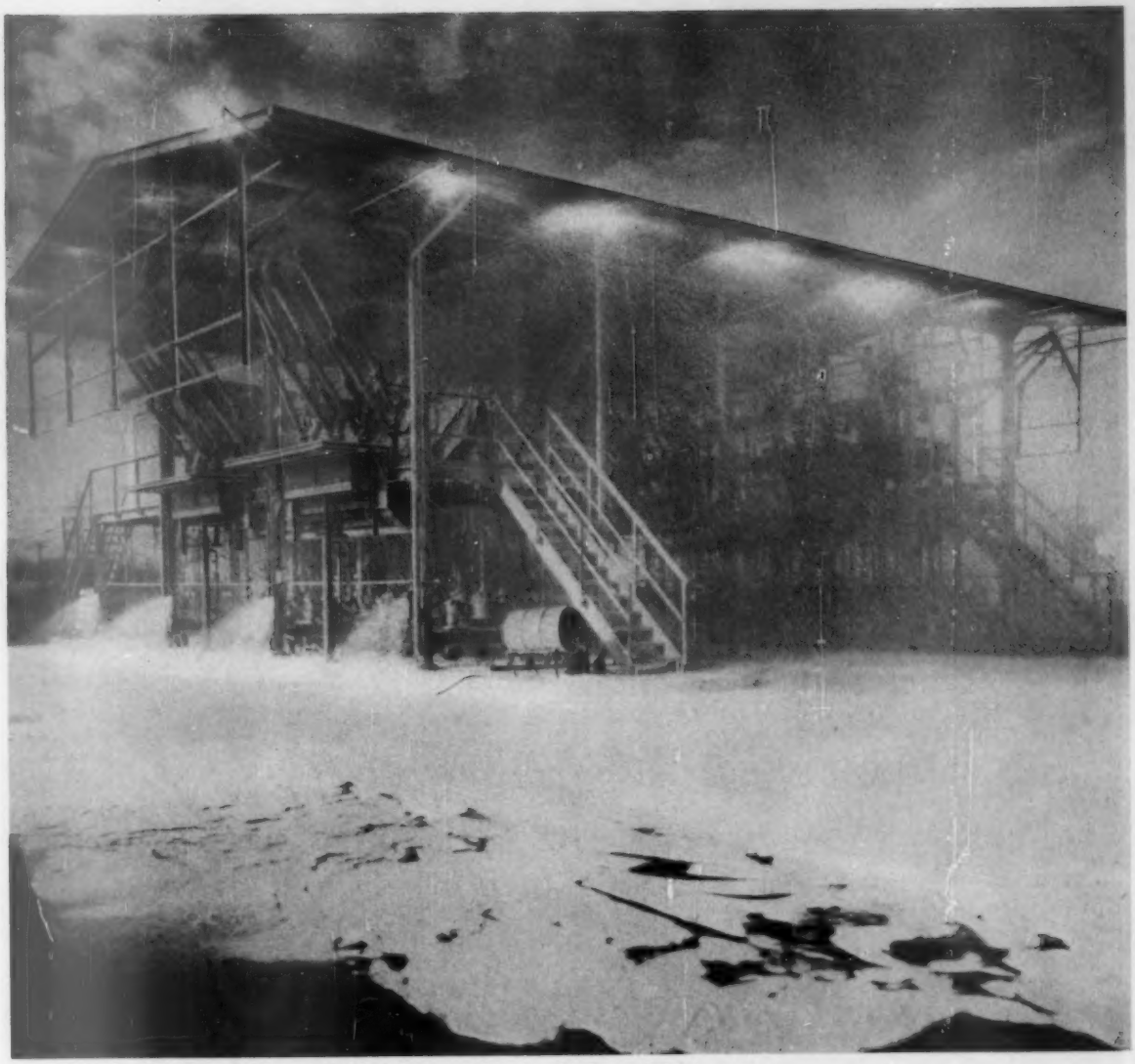

2 minutes after start of system under test. Note how fire-extinguishing foam blankets potential fire area.

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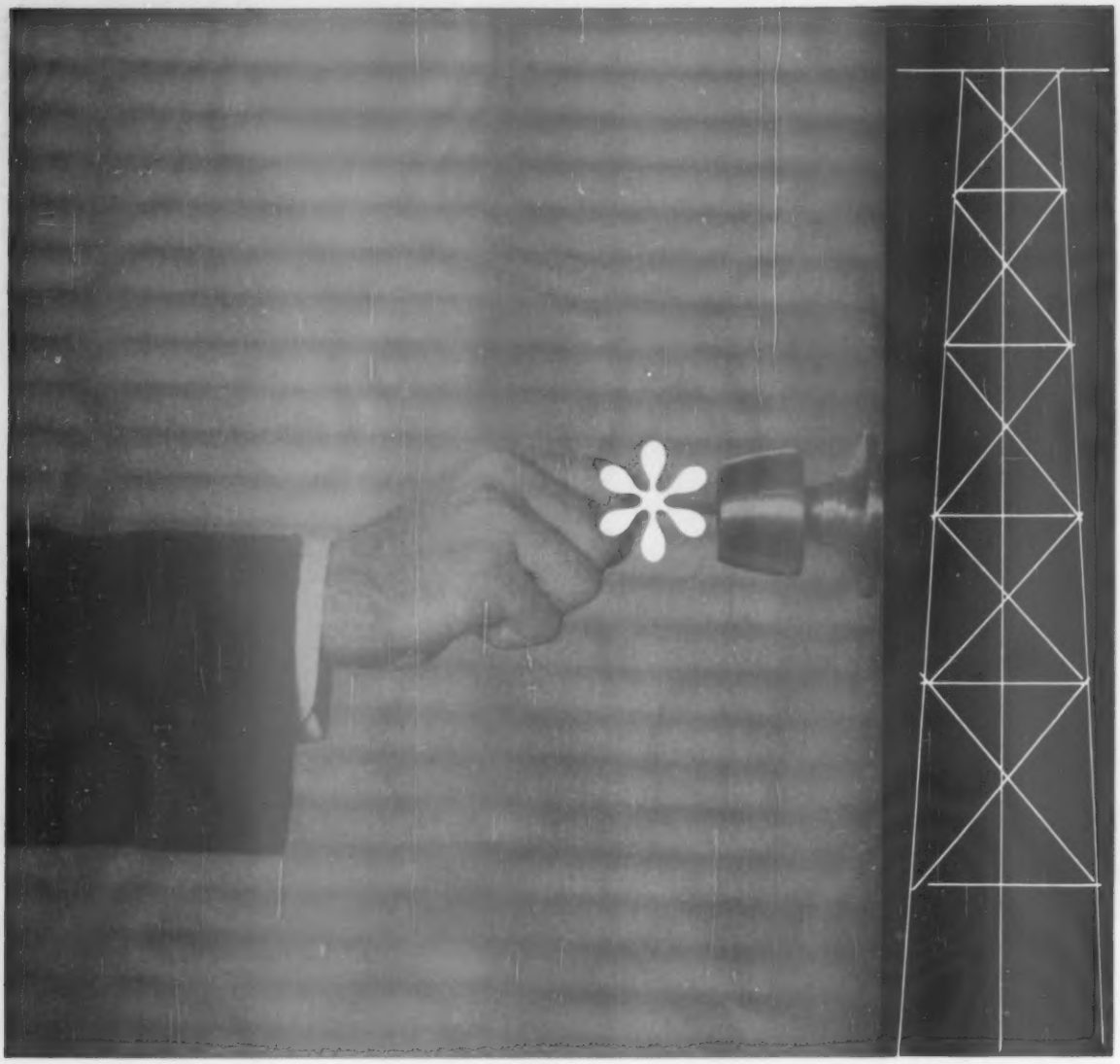

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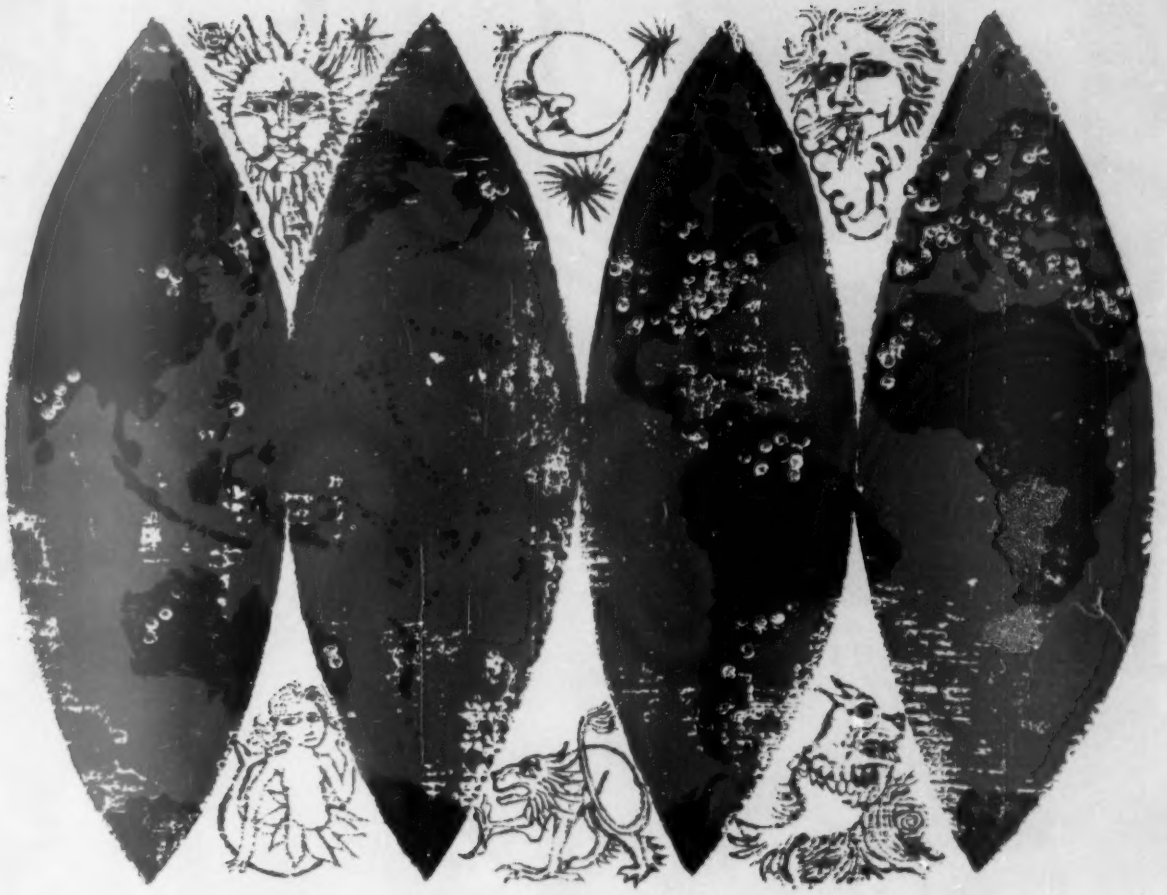

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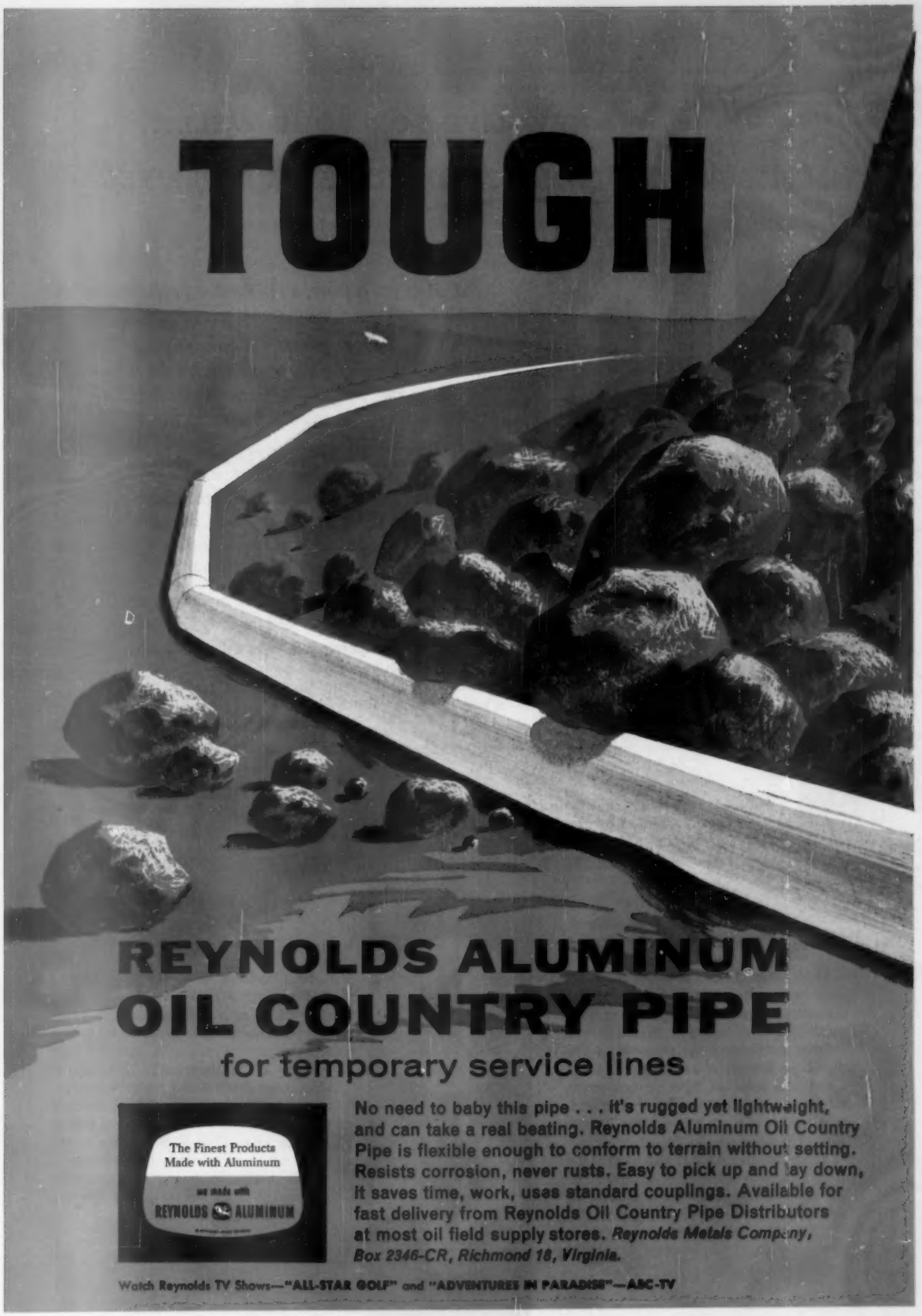
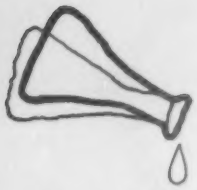
Basic in catalyst chemistry

CYANAMID

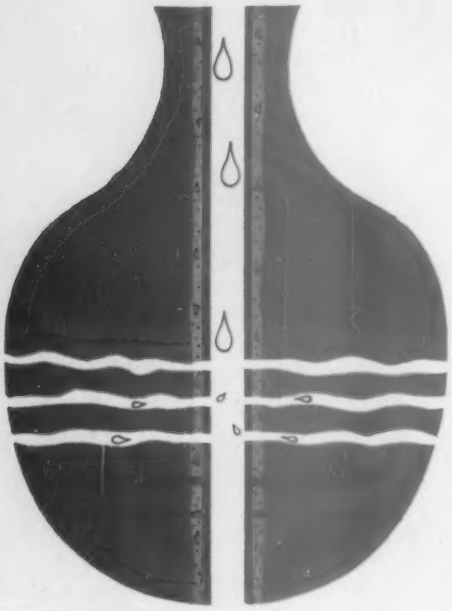
AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • 30 Rockefeller Plaza, N.Y. 20, N.Y.


TOUGH
REYNOLDS ALUMINUM
OIL COUNTRY PIPE
for temporary service lines
The Finest Products
Made with Aluminum
are made with
REYNOLDS ALUMINUM
No need to baby this pipe . . . it's rugged yet lightweight, and can take a real beating. Reynolds Aluminum Oil Country Pipe is flexible enough to conform to terrain without setting. Resists corrosion, never rusts. Easy to pick up and lay down, it saves time, work, uses standard couplings. Available for fast delivery from Reynolds Oil Country Pipe Distributors at most oil field supply stores. Reynolds Metals Company, Box 2346-CR, Richmond 18, Virginia.
Watch Reynolds TV Shows—"ALL-STAR GOLF" and "ADVENTURES IN PARADISE"—ABC-TV



NEW LIFE FOR YOUR WELL...

HALLIBURTON'S UNMATCHED ACIDIZING EXPERIENCE



If oil or gas is there, a Halliburton Acidizing Service will help you to maximum recovery.

In thousands of wells, Halliburton Acidizing Services have started new production and revived old production, by improving permeability, removing mud cake and breaking water and emulsion blocks.

Halliburton puts the industry's most effective chemical weapons against production barriers to work in your well, augmented by specifically designed, highly efficient tools. Experienced and trained field personnel, familiar with formation problems, skillfully apply these tools and chemicals for maximum recovery results.

Get all the benefits that only modern chemistry and physics can give to your well. Specify Halliburton... the world's most experienced service organization... for *your* acidizing needs!

HALLIBURTON CHEMICALS AND TOOLS...

KEYS TO HELP OPEN LOCKED DEPOSITS OF OIL

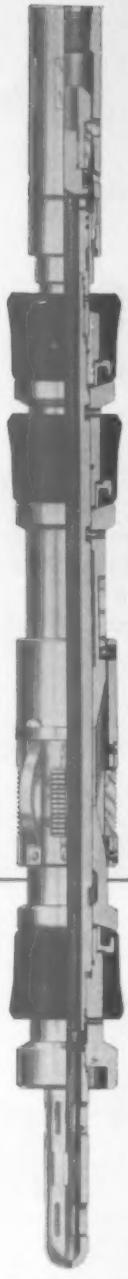
HYDROCHLORIC ACID

Hydrochloric Acid is most effectively used in the treatment of limestone and dolomite formations to improve permeability. The reaction products are soluble, permitting the removal of the dissolved limestone or dolomite in the spent acid solution. Specific non-emulsifying agents are mixed with the acid, when necessary, to prevent the formation of viscous emulsions.

Hydrochloric Acid is also used as the base fluid of Halliburton Acidfrac and in conjunction with other fracturing services.

HALLIBURTON'S "HV" ACID

Halliburton's "HV" (High Viscosity) Acid inherently delays reaction until the solution is at a greater distance from the well bore, with a resulting larger well drainage area. A comparable volume of Halliburton's "HV" Acid may cover from 4 to 9 times the drainage area of ordinary acid. Extremely useful for temporarily plugging highly permeable sections of well bore in old wells or those previously acidized... which diverts following non-emulsifying acid to other zones... thus opening up new drainage channels.



CUP TYPE RETRIEVABLE BRIDGE PLUG

HALLIBURTON CUP TYPE RETRIEVABLE BRIDGE PLUG

A self-sealing retrievable bridge plug – consists of cup type sealing elements which automatically seal by applying pressure differential – to provide a positive but easily removable plug in cased hole to help hold pressure from either above or below. A large area by-pass through the tool with a sleeve type by-pass valve at the top held open by the overshot is provided; also a large area slotted screen at the lower end helps prevent plugging of by-pass.

Tool may be run in alone on tubing as a temporary plug for treating down casing or for containment of pressure for surface workover operations. Especially adaptable for running in below the Halliburton Retrievable Test-Treat-Squeeze (RTTS) Packer to help isolate one or more zones for testing, treating, or squeezing operations. This compatible-combination permits "straddling" of any desired zone; isolating multiple zones individually for treating or testing procedure with *only one trip in the hole.*

HALLIBURTON MUD CLEANOUT AGENT (MCA)

Through the use of MCA, natural oil or gas flow channels may be reopened, and on cement jobs, cement is more firmly bonded to formations. If normal permeability has been plugged by mud cake or if mud is lost in the formation crevices and flow channels, an exclusive chemical constituent in MCA aids in softening and dispersing the mud for easier removal.

HALLIBURTON "R-3" TREATING PACKER

A new economical – short – compact – retrievable tool used for treating, fracturing, water flooding, and producing a well. Is run into cased hole on tubing to aid in isolating a section to be treated and may be set and reset on one trip. Can be set in tension or compression without modification. Consists of a packer rubber, drag springs, mechanical type slips mounted in a sleeve, and a J-slot arrangement. Full opening mandrel permits passage of wireline type tools, instruments or perforating guns. Available in 4½", 5½" and 7" O.D. casing sizes.

"R-3" TREATING PACKER

HALLIBURTON "Fe" ACID

Primarily designed to help prevent abnormal amounts of dissolved iron from precipitating after the hydrochloric acid is spent. Holds dissolved iron in solution allowing ample time for easier removal from the well which could act as a plugging agent in permeable channels.

"Fe" Acid is more applicable to treatments in water flooding or disposal wells . . . used to remove accumulated iron from the water or after acid reaction with rusty pipe, and then deposited at or near the well bore as hydroxides or oxide mixtures . . . where it reduces the input of water at previous pressures.

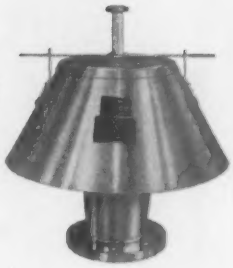
Halliburton Acid Inhibitors contain no arsenic or metalo-organic compounds

HALLIBURTON CHEMICAL SERVICES

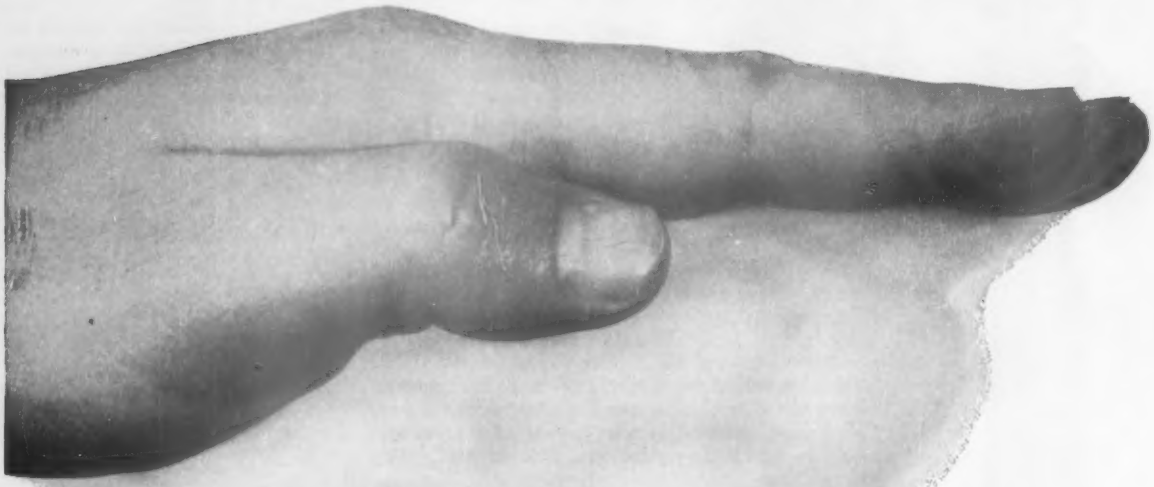
HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

NEW LIFE FOR YOUR WELL . . . WITH ACIDIZING

new **S&J** *Breather Valves*



Materially Reduce Storage Tank Vapor Loss



New Shand and Jurs model ST-9749 diaphragm-type breather valves are a major achievement in storage tank venting and vapor conservation. They provide resistance to sticking, corrosion and freezing never before offered. In addition they require practically no maintenance feature non-wetting teflon-on-fiberglas diaphragms for maximum performance and longer life; completely eliminate critical drain holes or other areas that require continuous checking. Ruggedly built from aluminum and stainless steel, ST-9749 breather valves are lightweight, and already available in 4″, 6″, 8″, and 10″ sizes. Call your nearest S&J branch office or sales representative for Technical Bulletin 52D-ST-9749 Breather Valve.

SHAND AND JURS

GENERAL PRECISION EQUIPMENT CORPORATION GPE

2600 Eighth Street, Berkeley, California
Branch offices and representatives in principal cities

the world's largest selection of oilfield rental tools.

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY Inc.
ASSOCIATED A OIL FIELD RENTALS

Homco-Associated offers you the largest selection of oil field rental tools in the world. With thirteen strategically located yards in the heart of the oil country, they are as close to you as your telephone.

Whatever your needs may be in the field of rental tools, your best bet is to call the **Homco-Associated** office nearest to you. You are assured that your call won't be wasted. You'll get the equipment you need and get it fast.

Whether it's pipe tongs or drill collars, blow-out preventors or adapter flanges, tubing spiders or Kelleys—we've got them, in top condition, ready for you. Call us and see what good service really is.

L O C A T I O N S

Texas: Alice, Beaumont, Houston, Odessa, Snyder • **Oklahoma:** Duncan, Oklahoma City • **Louisiana:** Harvey, Lafayette, Morgan City • **Mississippi:** Laurel • **New Mexico:** Hobbs • **Wyoming:** Casper

HOMCO HAS IT!

Petroleum
Refiner
OIL, GAS AND PETROCHEMICAL PROCESSING
JANUARY 1959
Look Like Record?
To the Editor:
We, the employes of the Yorktown, Virginia, four-drum coking unit, are seeking information about refinery record runs to see if we have not in fact set a new record run for a Delayed Coker.
We employes of American Oil Company were assigned to a new four-drum coker built by the Lummus Co., in 1956, and put on stream in January, 1957. We are now in run No. 4, and as of today, have been on stream 240 days* without even a partial shutdown. During this run we have averaged approximately 17,000 b/d through the furnace which is somewhat more than design, and to us means that we have not babied the unit for a long run.
The employes of this unit read your magazine and enjoy it very much and would appreciate it very much to see us recognized in your magazine for this accomplishment.
We would appreciate it very much if you will notify us as soon as possible whether we have or have not established this record and, if not, just what the record is.
Howard D. Rogers,
Operator
Yorktown, Va.

*—to date—
(March 25, 1959)
their record now stands at 354 days..

LUMMUS
ENGINEERS AND CONSTRUCTORS FOR INDUSTRY THROUGHOUT THE WORLD
385 MADISON AVENUE, NEW YORK 17, N. Y.
HOUSTON · WASHINGTON, D. C. · MONTREAL · LONDON · PARIS · THE HAGUE · MARACAIBO

DU PONT *Petroleum Chemicals* NEWS

Number 98 in a Series of Bulletins for the Petroleum Industry

SEPTEMBER-OCTOBER 1959

How to use winter weather and RP-2 to increase brand loyalty for your gasolines

New TEL Manager

JOHN R. SABINA is our new manager of the tetraethyl lead and planning section of Du Pont's Petroleum Chemicals Division. He replaces T. Baldwin Prickett, who retired March 31 after 33 years in the petroleum industry.

Mr. Sabina joined the Du Pont Company in 1937, heading a new group in the Organic Chemicals Department. In 1944, he became manager of the petroleum chemicals section and two years later became technical manager of the newly formed Petroleum Chemicals Division.

Has Published Many Technical Articles

Mr. Sabina holds a B.S. in Electrical Engineering from the University of Pennsylvania and was associated with the Atlantic Refining Company before joining Du Pont. He is well known for his numerous technical articles in the petroleum field and his activities in technical societies.

PERISH THE THOUGHT from all *your* customers' minds . . . by including Du Pont RP-2 in your fall and winter gasoline blends. Du Pont RP-2 prevents carburetor icing, the most common cause of stall annoyance that can frustrate motorists into switching gasoline brands. RP-2 also prevents rust, acts as a carburetor detergent and supplies valuable phosphorus credit.

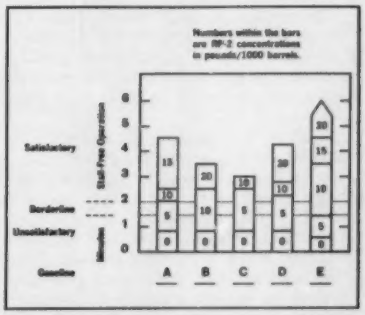
When the frost is on the ground and cold, wet winds once more fill the air, you'll have a better chance than ever to build up loyalty to your brand of gasoline.

It's when his car stalls that a motorist starts *shopping* for his gasoline and considers seriously which brand gives him the best performance.

We can help you cash in on this with Du Pont RP-2, an additive that gives three-way protection to your customers' cars and a "phosphorus bonus" to you.

Prevents stalling due to carburetor icing. RP-2 keeps throttle plates and throats of carburetors from being wetted by water droplets. Sufficient RP-2 in *your* gasoline will keep customers' carburetors from icing up during adverse weather. The chart on this page shows just how this affects anti-stalling properties.

Keeps carburetors clean RP-2 coats throttle plate, throat, and walls of carburetor, adds a detergent action which prevents foreign matter from building up into a choking scale. This action keeps new carburetors clean, cleans old carburetors previously used with gasolines unprotected by RP-2.



Controls rust RP-2 forms a barrier between metal and moisture, blocks rust formation before it can start . . . prevents rust in the fuel system and during storage, too.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

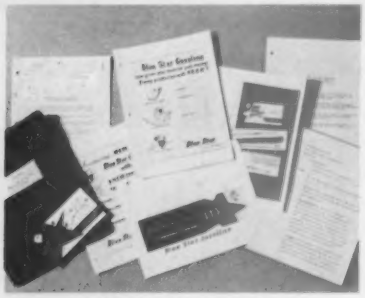
OVER

DU PONT *Petroleum Chemicals* NEWS

CONTINUED

Phosphorus credit You can take a phosphorus credit when you use RP-2. At 15 pounds per 1000 barrels, RP-2 adds about 0.03 theory of phosphorus to premium grade gasoline.

How to get started for next winter First, you'll want the complete technical story on RP-2, contained in a new bulletin. You can get a copy by calling your Du Pont representative or writing us direct.



You can follow this up with this complete merchandising and advertising kit, based on proven methods for getting the optimum attention from your market when you use RP-2 additive.

Have you heard about our linear programming service?

In case you missed our offer a few months ago, we take this chance to reiterate the fact that we have set up a linear programming service in our Petroleum Chemicals Division.

This service can help you organize the vital variables of processing and blending in such a way that modern calculation methods can be applied to get an integrated analysis of all gasoline manufacturing operations.

A study covers such factors as: the value of each gasoline component . . . optimum reformer severity . . . the volume of components which should be purchased or sold . . . the product quality shortage or give-away on all inspections related to specifications . . . the loss sustained by diverting components to other grades of gasoline or products through choice or necessity . . . and economical use of tetraethyl lead.

For more information on this service, see your Du Pont representative or write Du Pont, Petroleum Chemicals Division, Wilmington 98, Delaware.

FOA-2 gives fast answers to sludging problems from heavy fuels

At a large industrial chemical laboratory, Du Pont FOA-2 was added to a sludge-ridden tank during fuel delivery. Tank was successfully de-sludged with only $20 worth of FOA-2, with no down-time. This eliminated need for $800 mechanical cleaning.

A chemical manufacturing plant found it could save $600 per cleaning by using Du Pont FOA-2 in an eighteen-U-tube oil heat exchanger which previously had to be dismantled twice a year for cleaning.

At a large laboratory, operators no longer have to clean the burner tip in their boiler every five days . . . in fact, they have not cleaned it at all since they started adding FOA-2 to their fuel, months ago.

A large office building had to clean a burner nozzle every day, including weekends. FOA-2 makes it possible for the same burner to run for four days without a cleaning.

A chemical plant had a serious sludge problem in its preheater when tubes became plugged with deposits so hard they couldn't be cleaned at all. Since adding FOA-2 to their fuel, this problem has ceased and over-all cleaning time has been cut by four-fifths.

These are just five of many recent success stories for FOA-2.

If you're having a sludge problem from the use of heavy fuels, such experience shows that you can count on eliminating or at least minimizing the problem with the help of FOA-2.

If you'd like to know more, contact the Du Pont Petroleum Chemicals Division representative nearest you, or write us direct for a bulletin.

SALES OFFICES

Chicago 3—8 So. Michigan Ave. . . . . RAndolph 6-8630
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Seattle 3—4003 Aurora Ave. . . . . MElrose 2-6977
Tulsa 1—1811 So. Baltimore Ave. . . . . LUther 5-5578
In Canada—Du Pont of Canada Limited, Petroleum Chemicals, 85 Eglinton Ave. East,
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DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

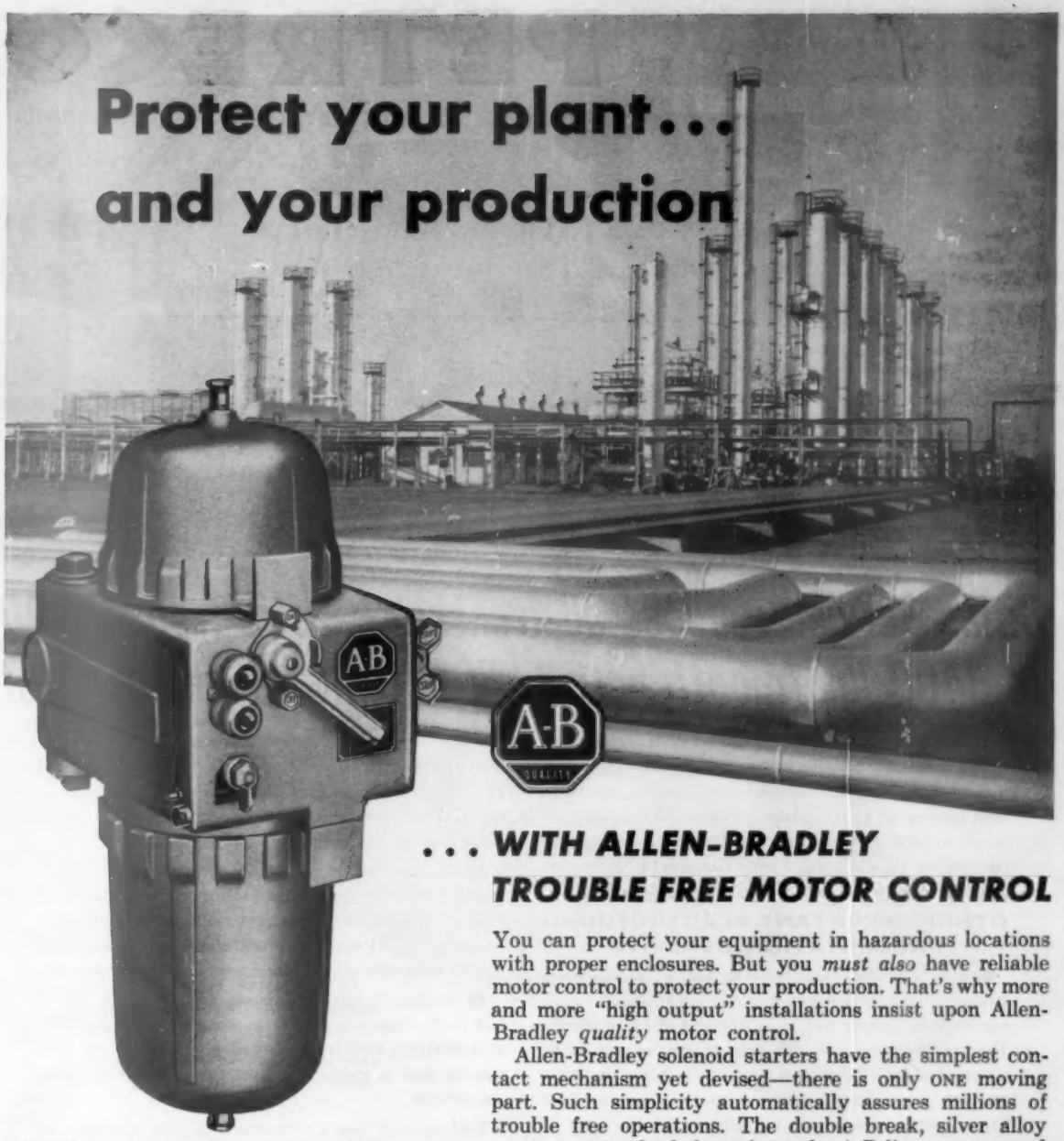
Du Pont Tetraethyl Lead and other Petroleum Additives

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

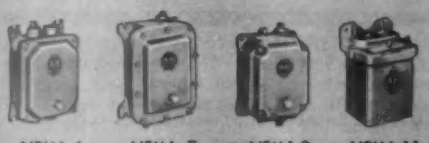
A-11520

Printed in U.S.A.



Bulletin 713 combination starter in Crouse-Hinds screw type enclosure for hazardous gas and hazardous dust locations. Screw type covers permit quick access to starter or circuit breaker.

A-B enclosures are available for all types of installations



NEMA 4 Watertight Weatherproof | NEMA 7 For Hazardous Gas Locations | NEMA 9 For Hazardous Dust Locations | NEMA 11 Corrosion-proof

. . . WITH ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROL

You can protect your equipment in hazardous locations with proper enclosures. But you *must also* have reliable motor control to protect your production. That's why more and more "high output" installations insist upon Allen-Bradley *quality* motor control.

Allen-Bradley solenoid starters have the simplest contact mechanism yet devised—there is only ONE moving part. Such simplicity automatically assures millions of trouble free operations. The double break, silver alloy contacts—standard throughout the A-B line—never need servicing. In addition, the permanently accurate thermal overload relays give reliable protection against dangerous overloads, no matter what the atmospheric conditions or how long the overload relays have been in service.

Protect your production while protecting your plant . . . specify Allen-Bradley quality . . . it will do this job efficiently and reliably.

ALLEN-BRADLEY

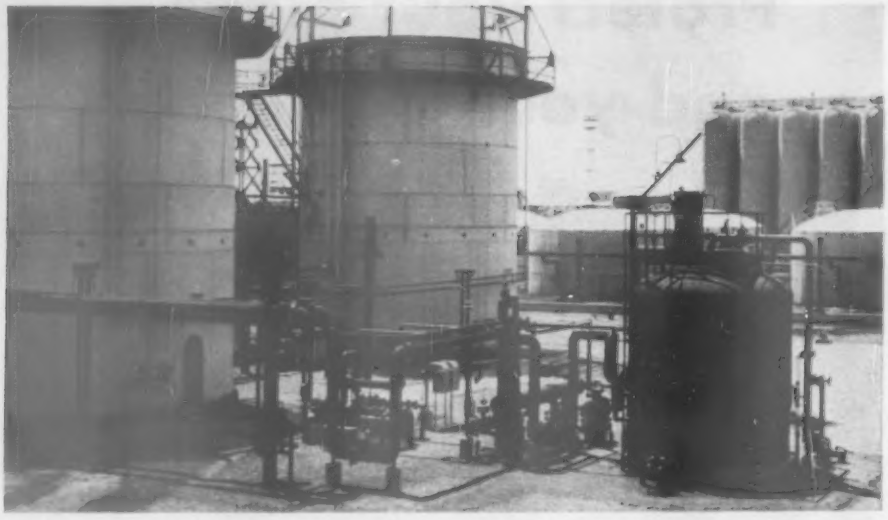
Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1304 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

PRODUCT IMPROVEMENT WITH

PETRECO



Compare the small, compact Petreco Electrofining Precipitator in the foreground with the large-diameter, twice-as-high open agitators.

Cities Service reduces oil-treating caustic from 15000 to 3400 lbs./month with ELECTROFINING precipitator*

Since the Cities Service Oil Company refinery in East Chicago, Indiana, replaced its two large air-blown agitators with an ELECTROFINING Precipitator, the caustic needed to treat burning oil has been reduced from 15000 pounds per month to 3400 pounds per month. This is possible because the intense caustic contact with the ELECTROFINING Precipitation Equipment enables *less caustic to do more work.*

OTHER IMPORTANT ELECTROFINING PRECIPITATION BENEFITS

■ *ELECTROFINING Precipitation Equipment Simplifies Waste Disposal.* When agitators were used, 15000 pounds of oil contaminated caustic had to be disposed of every month. The ELECTROFINING unit has reduced the amount to be disposed of to 3400 pounds per month. Since the ELECTROFINING unit is vapor-tight it permits no escape of oil vapors to the atmosphere as the agitators did.

■ *Requires Less Construction Material; Less Space.* Note the physical difference. The amount of sheet steel and pipe required for the construction of the agitators was many fold that used in the custom-built, virtually pre-fabricated ELECTROFINING Precipitator. The real estate occupied by the ELECTROFINING unit is only one-third the amount of space required by the agitators.

■ *Replaces Manual with Automatic Operation.* Agitator treatment is controlled by the judgment and experience of human operators. ELECTROFINING units are automatically controlled at all times to provide optimum treating efficiency as established by laboratory pilot-plant operation.

■ *Reduces Heating Requirement.* After agitation the oil had to be heated to 120°F. to remove water haze. The ELECTROFINING unit treats the oil at 85°F. and no after treating heat is required so that total fuel requirements are reduced.

Find out now how ELECTROFINING in your operation can save dollars and make sense. Write or call . . .

*ELECTROFINING *is a registered trademark of Petrolite Corporation.*

DT 59-1

PETROLITE CORPORATION

PETRECO DIVISION

3202 South Wayside Drive (P.O. Box 2546), Houston 1, Texas
1390 East Burnett Street (P.O. Box 7216), Long Beach 7, California

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ENGLAND: Petrolite Limited, Heathcoat House, 20, Savile Row, London W. 1.

VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

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COLOMBIA: W. F. Faulkner, Calle 19, No. 7-30, Office 807, Bogota

ITALY: O. Wagner, 149 Via Nemorense, Apt. 1, Rome

JAPAN: Chiyoda Chemical Engineering and Construction Company, Ltd., Tokyo Bldg., No. 3, Marunouchi 2-Chome, Chiyoda-Ku, Tokyo

KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait

MEXICO: R. E. Power, Sierra de Mijes, No. 125, Mexico D. F.

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The best features of modern bearing design — combined and refined in

Spherical

ROLLER BEARING PILLOW BLOCKS BY LINK-BELT

MAXIMUM SIZE ROLLERS

HIGH, HEAVY INNER RACE FLANGES

CENTRIFUGALLY CAST BRONZE RETAINERS

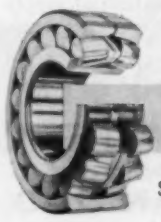
Big, mirror-smooth, convex rollers . . . hefty inner race flanges . . . centrifugally cast bronze, precision-machined retainers. They're industry's *preferred* bearing features. And they're *all* found in Link-Belt's new spherical roller bearing . . . compactly combined in an exceptionally durable two-piece housing.

These self-aligning roller bearing pillow blocks take misalignment in stride—adjust immediately in any direction while maintaining full load capacity. Two types of shaft mountings facilitate installation . . . adapter mounting for commercial shafting and direct shaft mounting for shafting ground to recommended tolerances. And Link-Belt's rugged steel multi-labyrinth or dacron-contact seals lock out dirt, lock in lubricant.

For details, call your Link-Belt office or authorized stock-carrying distributor, and ask for new 52-page Book 2760. Look under BEARINGS in the yellow pages of your phone book.

15.101-B

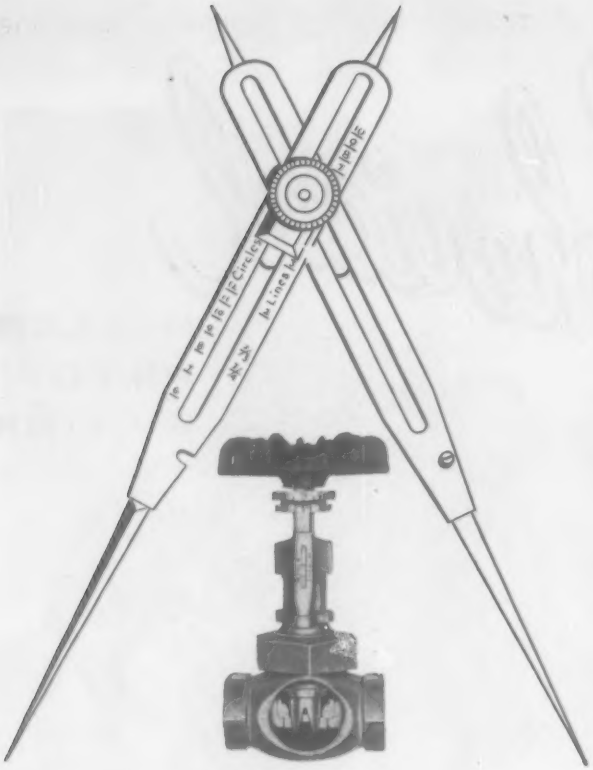
Series 6800, 6900, 7800, 7900 roller bearing pillow blocks have spherical roller bearings with internationally standardized boundary dimensions.



LINK-BELT

SELF-ALIGNING BALL AND ROLLER BEARINGS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.



PROPORTIONER

controls flow to save for you

The V-port disc in all Hancock "Flocontrol" Valves insures proportional flow throughout the entire lift of the stem. They are valves that help you achieve uniform product quality through closer control, save steam and fuel on process work, and cut maintenance costs.

"3 in 1" valve design combines variable orifice with shut-off and micrometer dial and pointer. The valve opening can be set within 1/10 turn of the handwheel —you can duplicate all settings easily, instantly. No shut-off valve required—flow is in a straight line, with separate shut-off seating surface located away from the V-ports.

Hancock "Flocontrol" Valves are available in Bronze and Steel to meet the most demanding services. Ask your industrial supply distributor for details.

Hancock "Flocontrol" valves assure positive pinpoint control—eliminate all guesswork.

MAXWELL M&M MANNING & MOORE INC. TRADE MARK

HANCOCK "FLOCONTROL" VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Watertown, Massachusetts
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

STANDBY PUMP, powered by International UV-549 engine, is shown in foreground of this panoramic view of Union Oil Co. refinery.

Refinery powers standby fire pump with dependable International V-8

In case of an emergency, the Union Oil Co., refinery at Santa Maria, Calif., calls on this standby Peerless fire pump driven by an International UV-549 8-cylinder carbureted power unit.

The refinery has a 50,000-gallon tank that feeds water directly to the pump that delivers it at the rate of 1,500 gpm under 100 pound pressure to all parts of the plant through a network of 6-inch pipeline. The International engine gets fuel from a 20-gallon drum mounted to give gravity feed directly to the carburetor. The engine is cooled by a jacket-type heat exchanger over the pump outlet. Safety switches shut down the engine should overheating or oil pressure failure occur.

For the most dependable power your money can buy for pumps or pump jacks, check your nearby International Power Unit Distributor or Dealer. His 32-model line includes carbureted or diesel engines ranging from 16.5 to 385 max. hp. And all dependable International engines have one common feature: Fastest payback power.

International® Construction Equipment

International Harvester Co., 180 N. Michigan Ave., Chicago 1

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

SILICONE NEWS from Dow Corning

Found: A Paint that Lasts

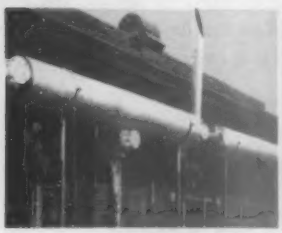
Cut Costs with New Long-Lived Silicone Finishes

You paint your plant to protect against rust and rot, but how can you protect the paint? Sun, rain, heat, sleet, smoke, and other elements of the industrial climate take a heavy toll. Shortly after the paint is completely dry, it starts to deteriorate. Soon, it must be re-applied. Thus, the cost of keeping away rust can run high: not due to the price of the coating material as much as to the repainting time involved.

Now, however, new paints based on silicone resins make it possible for you to make some really substantial cuts in paint maintenance costs. Proven to have superior durability, these silicone finishes last a good 25% to 100% longer. They keep their gloss and color and film integrity despite tough exposure to weather . . . despite high temperatures that burn or crack conventional finishes.

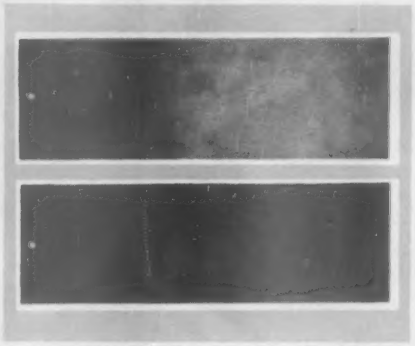
Naturally, this greater staying power means fewer repainting jobs. And that's especially important in hard-to-get-at areas of the plant, or on hot-running equipment that must be shut down for painting.

For instance, the Austin White Lime Company, of Austin, Texas, had difficulty keeping paint on the kilns and stacks shown above. Then they tried a paint based on Dow Corning Silicones, and report it "... by far the most satisfactory paint we have ever used." You can see the gleaming results.



Many other firms have come to the same conclusion. At left are two diesel mufflers at the Philadelphia Gas Works. Both were painted two years before these pictures were taken; one with an organic coating, the other with a silicone finish. The burned, cracked and discolored paint is the organic; the "like-new" coating is the silicone.

What if there's no heat problem, just weathering? New silicone-based coatings outlast conventional paints even where high temperatures are no problem. Look at the test panels in the photo. These panels have been exposed for one year in an industrial location where corrosive atmospheres frequently prevail. The conventional organic paint has faded, lost its gloss and chalked badly, while the silicone finish (bottom) is still in fine shape.



Colors Unlimited . . . Silicone finishes run the complete spectrum. If you want a hot-spot finish that will resist 1,000 F, certain pigments such as aluminum must be used.

But, when temperatures are not high enough to damage the pigment, you can get virtually any color you wish. This is important, for it means that, for the first time, you can carry color-coding systems over onto hot equipment without worrying about early paint failures.

Product finishes based on Dow Corning Silicones further prove the resistance to chalking, checking, fading and oxidation of these resins. For example: Sherer-Gillett, Marshall, Mich., a major producer of refrigerator display cases for supermarkets, has found a silicone-based enamel superior in durability . . . retaining high gloss after long wear . . . capable of absorbing more abuse.

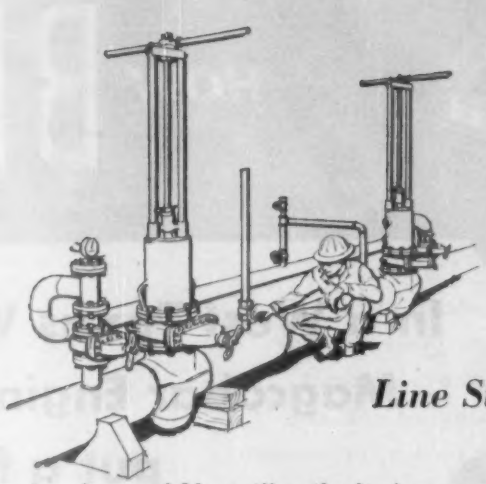
Why not investigate silicone paints for your plant? Send today for the descriptive brochure, "Why Silicone-Based Paints Mean Less Maintenance." Write Dept. 2922.

Your nearest Dow Corning office is your number one source for latest information and technical service on silicones.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

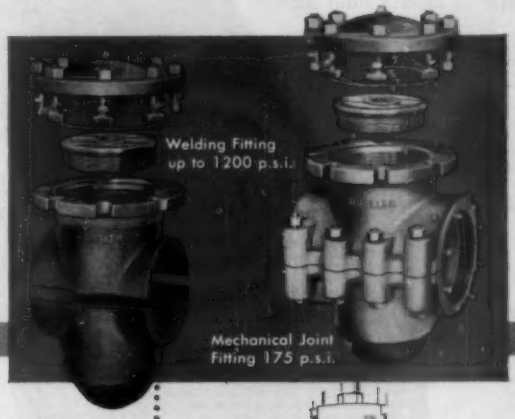


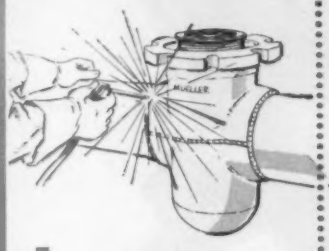
stop-off high pressure lines where there are no control valves!

here's how—with MUELLER® Line Stopper Fittings and Equipment

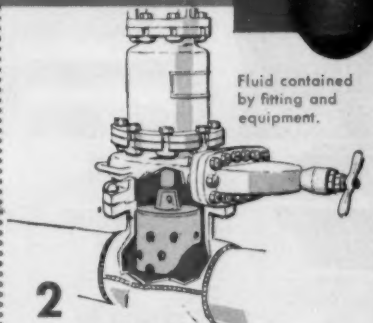
These drawings quickly outline the basic procedure used in stopping-off a line under high pressure with Mueller Line Stopper Fittings and Equipment. Line Stoppers may be used at any point on any type of line. Once installed, the fittings may be re-used for future stop-offs.

Only the major steps are shown here. Write direct for the complete story and specifications.

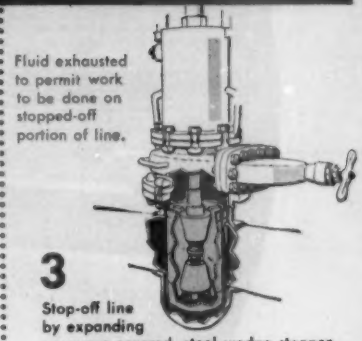




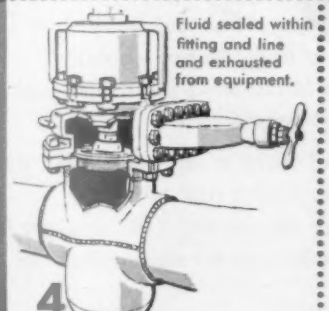
1
Weld fitting to line.



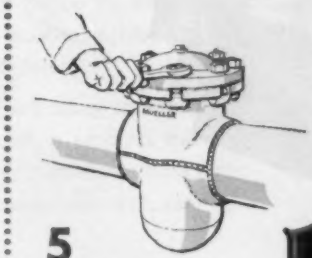
2
Cut out pipe inside of fitting to accommodate cylindrical stopper.



3
Stop-off line by expanding neoprene-covered, steel wedge stopper.



4
Insert completion plug into top of fitting.



5
Bolt completion cap in place on fitting.

MUELLER CO.
DECATUR, ILL.

MUELLER CO. since 1857 QUALITY

NO-BLO®

® Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

HOW BIT

In a West Texas Well, Magcobar Engineers put a film here.....

Another Well Done *with*

LUBE AND MAGCOBAR ENGINEERING CUT DRILLING COSTS

You are always sure of getting every cost-cutting advantage with Magcobar. Here's why: The Magcobar Mud Engineer combines a thorough knowledge of drilling fluid chemistry with experience in your drilling area. This background—plus the top mud lab in the country—gives new dimension to the finest and most complete line of drilling mud products. What does this mean to you? The highest level of product performance to cut your drilling costs.

..... to make net savings of $4.87 per foot

Here's proof of actual savings using Bit Lube (E. P. Additive for Mud). The table below shows a drilling cost comparison in the Brownfield, Texas, area. The Bit Lube well was drilled for $4.87 per foot less than the offset well.

	NO. BITS	BIT SIZE	INTERVAL	ROTATING HOURS	WEIGHT ON BIT	RPM
BIT LUBE-WATER	28	7⅞"	4919-7272	185	70-90,000	60-80
WATER	40	7⅞"	4936-7270	379	45-60,000	55-80

Total savings in bits, trips, and drilling time was $13,420. Bit Lube and emulsifiers cost $1,940; a net saving of $11,480!

Bit Lube forms a tough protective film to reduce friction and to increase bit bearing life under extreme pressure conditions. It works best with high weight on the bit and fast rotary speed. Bit Lube and Magcobar engineering may be the answer to your bearing failures.

Bit Lube is only one of Magcobar's many answers to the problem of high drilling cost, a problem that demands the right answers. You'll find that the right products *used right* by Magcobar can cut costs on your next well, too.

Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION
HOUSTON, TEXAS

59-200

Magcobar Technology !

Today's smallest two-way mobile radio - actual size!

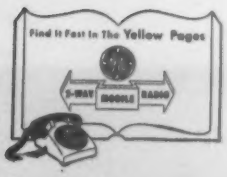
New General Electric Transistorized Progress Line

General Electric's new Transistorized Progress Line will fit in more places, in more different positions, than any other two-way mobile radio you can buy today.

Not only is this the world's smallest, lightest commercial two-way mobile radio, but standby battery drain is so low you need never turn off your TPL mobile unit, just like the clock in your car. You install no special generator, use less gas, require fewer engine jobs.

TPL is the first two-way radio that transmits up to 75 watts of power in high band . . . the first that really fits under the dash . . . the first to realize the full benefits of transistorized design (no more than four tubes) . . . the first to eliminate bulky cables through new one-piece design of receiver control and transmitter . . . the first with shielded dirt-free ventilation.

The new General Electric TPL ushers in a new era of convenience and reliability in mobile communications. Don't miss all the exciting details. Write General Electric Company, Communication Products Department, Section 18109-5, Mountain View Road, Lynchburg, Virginia.



GENERAL ELECTRIC

Communication Products Department

APPLIED EXPERIENCE

is an invaluable design factor of every

MARLEY CLASS 600 DOUBLE-FLOW

The future of an industrial cooling tower is no better than its background. Its performance and service life are dependent wholly on the practical experience and specific product knowledge of the people who design it. This suggests that you consider people as carefully as you consider price if you are to receive full-value returns from your investment.

When you buy a Marley Double-Flow, qualified people and abundant experience are basic parts of your purchase. You contract for the services of the industry's largest staff of engineering specialists, and each member—from years of specialization in thermal performance, structural and mechanical design, or application economics—contributes materially to the *true* value of the product you buy.

Of equal importance is the company's overall experience gleaned from designing and building 6,854 fan cells of large capacity industrial Double-Flows in the last 21 years . . . the sound basis of all Marley engineering. The only adequate file of authentic information on cross-flow cooling is the service history of all these installations. It evaluates every advancement and innovation in cross-flow cooling and, of course, is available only to Marley engineers.

At its Research Center, the company accelerates the acquisition of experience. In this excellently equipped facility, 30 engineers and technicians intensively test and analyze materials, equipment, components, complete towers; they scientifically appraise the value of theoretical approaches to new standards of cooling performance and operating economy. From experience gained through this program, Marley develops the steady flow of design advancements that pace the industry.

The ability of Marley people to apply their extensive experience to cooling tower design is demonstrated by the results of tower tests made public annually. Year after year, they prove that Marley Double-Flows — THE ONLY TOWERS WITH A PUBLISHED RECORD OF PERFORMANCE—consistently meet the most exacting specifications of purchasers in every industry.

All these [illegible] installations. Bulletin CF-59, request a copy from your Marley [illegible]

MARLEY

The Marley Company

Kansas City, Missouri

No waste motion! This pipe stabs, spins-in, tongs-up fast and tight. Utmost uniformity assures positive roundness... clean, accurate threads. Utmost uniformity assures sweeter running every time!

CASING AND TUBING

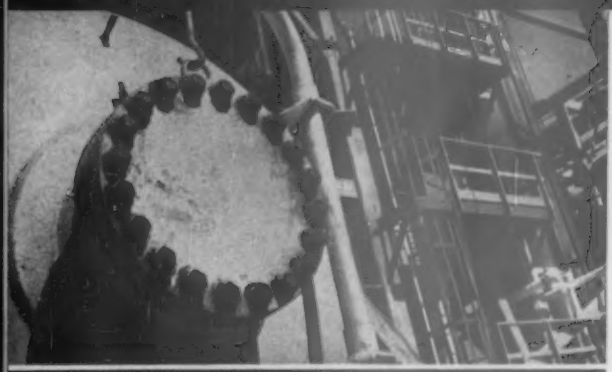
SPECIFY REPUBLIC. Fast shipment from mill or distributor stocks.

REPUBLIC STEEL

CLEVELAND 1, OHIO

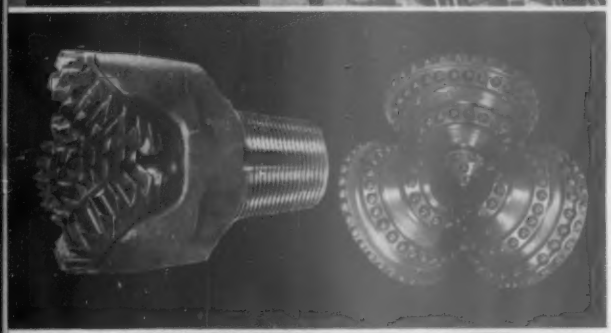
World's Widest Range of Standard Steels and Steel Products

from



...Powerful, Clamping Action

High-strength Republic Alloy Studs and High Carbon Hex Nuts provide safe, leakproof performance on high pressure equipment. Withstand massive force applied continually or cyclically—without distortion, creep, stretch, or fatigue failure. Full formed, accurate threads allow nuts to be pulled up tight and backed-off quickly to meet maintenance requirements.



...Stubborn Resistance to Wear

Republic Alloy Steels are exceptionally tough and durable. Resist shock, abrasion, and fatigue of round-the-clock operations. Higher strength-to-weight ratios, with no sacrifice in strength or safety, make them ideal for use in gears, shafts, bearings, tools, and equipment like these extremely hard and tough drilling bits.

...Fast, Low-Cost Installations

Republic Plastic Pipe is easily cut and joined in seconds using handsaw, brush-applied solvent, and slip-type couplings. Plastic pipe eliminates corrosion problems. Withstands severe impact yet is exceptionally light-weight. Republic produces a complete range of sizes in SRK (Semi-Rigid A.B.S.), SRB (Semi-Rigid Butyrate), and FE (Flexible Polyethylene). Send for facts.

REPUBLIC STEEL CORPORATION
DEPT. OG-7437-R
1441 REPUBLIC BLDG. • CLEVELAND 1, OHIO

Please send more information on:

- ☐ Republic Casing and Tubing
- ☐ Alloy Steels
- ☐ Alloy Steel Studs and Hex Nuts
- ☐ Republic Plastic Pipe

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

REPUBLIC STEEL

Meet your need for CHEMICAL RESISTANCE with hose of Du Pont TFE resins

Hoses lined with TEFLON are used here to handle chemicals and solvents in compounding cosmetics, colognes, room deodorants and insecticides. "Waxy" surface of TEFLON prevents holdup, absorbs no odors, and permits easy cleaning for service changes without contamination.

If resistance to acids and solvents is a *must* in your process, consider hose lined with TEFLON TFE-fluorocarbon resins. These tough materials are totally inert to virtually every chemical encountered in industrial processes. Hose lined with a TEFLON TFE resin is rated for continuous use up to 500°F. and will handle superheated steam; yet it is useful even in liquid-oxygen service. It is tough, long-lasting, and solves problems of holdup and contamination because adhesive substances won't stick to the "waxy" internal surface.

This unique combination of properties makes hose lined with TFE resin ideal for the toughest service conditions. And now, new constructions especially for industrial applications include fiber reinforcements, elastomeric coverings, convoluted tubing for greater flexibility, and a variety of industrial couplings.

Consult your dealer, or write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room T-30105, Du Pont Bldg., Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.

DU PONT TEFLON®

TFE-FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

This valve seat repairs itself

You Can't Cut, Scratch or Warp it!

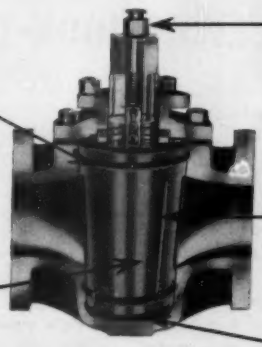
You're looking at a phantom view of the *pressurized lubricant* Sealdport® system in a Rockwell-Nordstrom valve. This pressurized lubricant is actually a *basic part* of the valve . . . it's the "part" that makes the big difference in terms of giving you longer valve life, tighter shut-off, and unequalled dependability.

Lubricant sealing in the exclusive Sealdport® system is the most simple yet effective valve seal imaginable. Under pressure, the lubricant becomes a powerful, impenetrable seal between the plug and body. And, much like a self-sealing auto tire, this seal can't be permanently cut, scratched or damaged. It actually *repairs itself.*

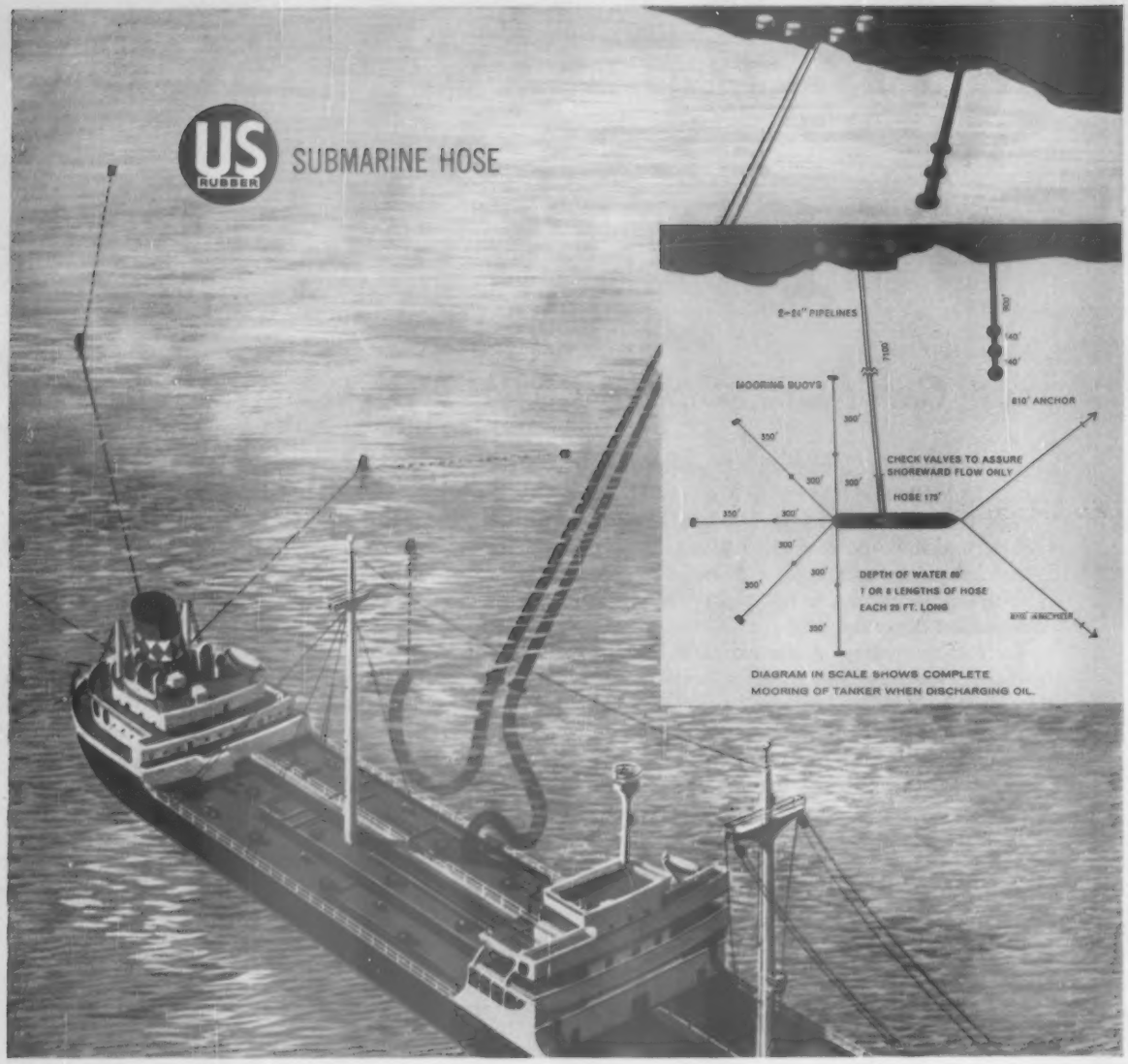
You'll get two other important advantages over ordinary valves when you specify Rockwell-Nordstrom: *dependability* and *economy.* Lubrication makes the difference again by eliminating the metal-to-metal wearing friction that ruins ordinary "dry" valves so quickly. And lubricant hydraulically "cushions" the plug for fast, easy ¼-turn operation.

Try just *one* Rockwell-Nordstrom valve and you will see why over 6,000,000 are in use today. You can have a Rockwell Field Engineer visit you with complete details by writing: Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Ltd.

ROCKWELL-Nordstrom VALVES
another fine product by
ROCKWELL


UNEXPOSED SEATING can't be corroded or eroded by line materials or high pressures.
LUBRICANT FITTING makes lubrication fast, easy and simple . . . valve can be lubricated or adjusted while in operation.
LEAKPROOF SEALING is insured by pressurized lubricant in Sealdport® sealing grooves . . . seats can't be cut, scored or warped.
WEAR IS ELIMINATED by film of lubricant on all vital surfaces.
HYDRAULIC JACKING of lubricant pressure keeps plug free for instant, quarter-turn operation.

Lubrication makes the difference . . . . .


US RUBBER
SUBMARINE HOSE
2-24" PIPELINES
7100'
MOORING BUOYS
810' ANCHOR
CHECK VALVES TO ASSURE SHOREWARD FLOW ONLY
HOSE 175'
DEPTH OF WATER 80'
7 OR 8 LENGTHS OF HOSE EACH 25 FT. LONG
DIAGRAM IN SCALE SHOWS COMPLETE MOORING OF TANKER WHEN DISCHARGING OIL.

From tanker to shore...the hook-up is U.S. Amazon Hose

The only submarine unloading point for oil tankers on the East Coast is at the Northville Dock Corp., Long Island, N.Y.

The operators say that submarine unloading would be impossible without hose of this character. Foreign and domestic tankers use this undersea hose (7100 feet offshore) as a hook-up to pipelines discharging heavy and light fuel oil directly into storage tanks on shore. Expensive dock and wharfage facilities are eliminated. *The tankers are moored at sea.*

The U. S. Amazon® Hose H2323 in use here resists the corrosive action of salt water and the turbulent action of swift tides. Its lightness and flexibility enable crew members to make it fast to the deck headers in record time. Also it curves easily from the water to the deck. There is never any sharp bend to impede flow.

Similar installations for other oil companies are located at world-wide points, proving the soundness of the construction features and the over-all quality of U. S. Amazon Hose.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

United States Rubber

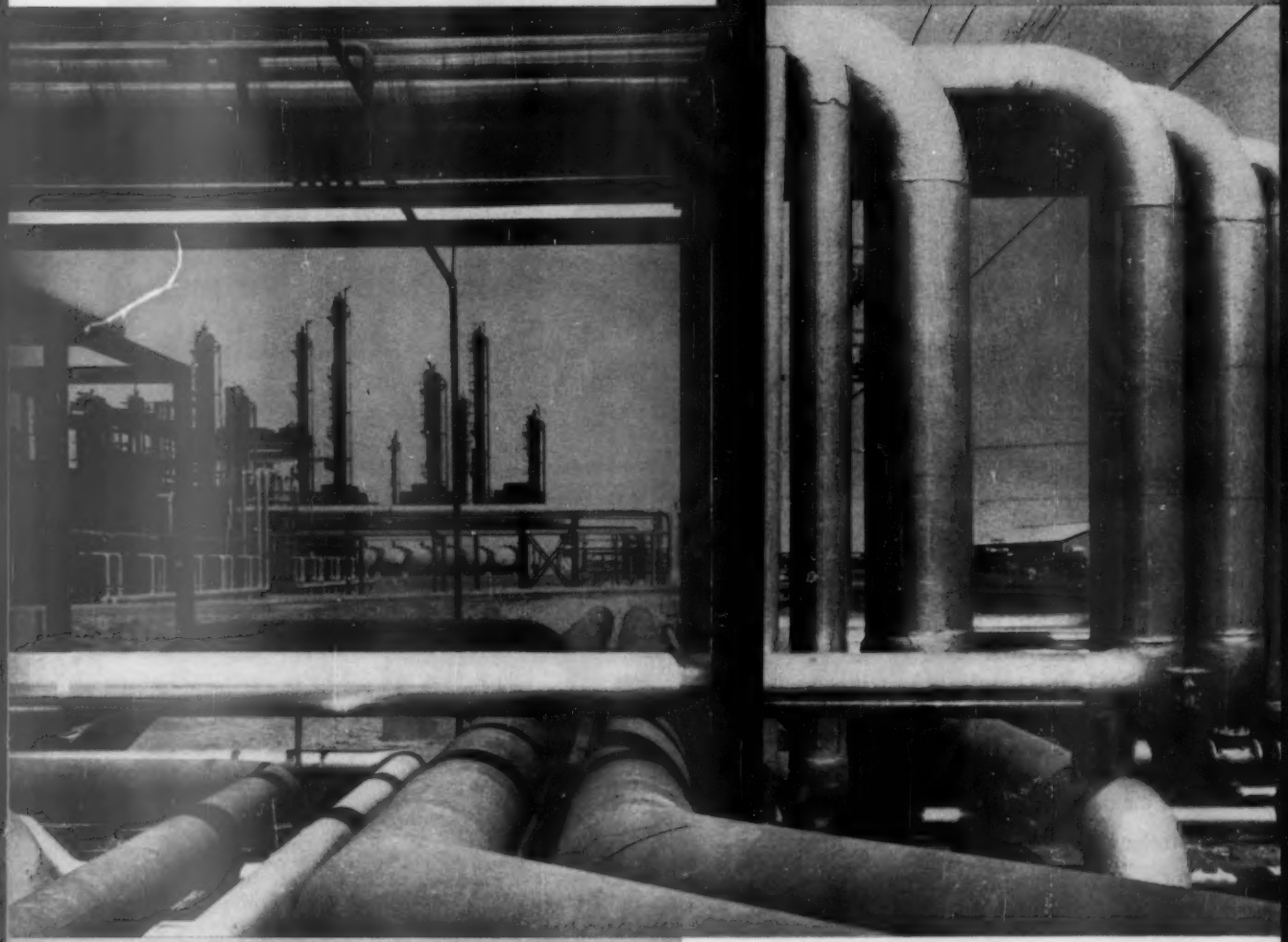
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

FAIR EXCHANGE: Acetic anhydride for "wash-'n-wear"

Due to their hydrophobic characteristics, synthetic fibers are increasingly popular in the "wash-'n-wear" market — with such organic chemicals as acetic anhydride as basic raw materials. Using their own direct oxidation process, with butane and propane as the normal charge, Celanese Corporation of America produces an entire series of these chemicals at its Pampa, Texas plant (below) . . . acetic anhydride, acetic, propionic and butyric acids, acrylate esters, vinyl acetate, acetaldehyde and methanol.

Western heat exchangers, performing with characteristic reliability and efficiency, have played an important role in heat transfer applications in the oxidation process at Celanese-Pampa since its initial construction in 1952.



The broadening experience of Western's engineering and technical staff in the petro-chemical industry is available to you for future heat transfer applications. We will feel privileged to serve you.

WESTERN

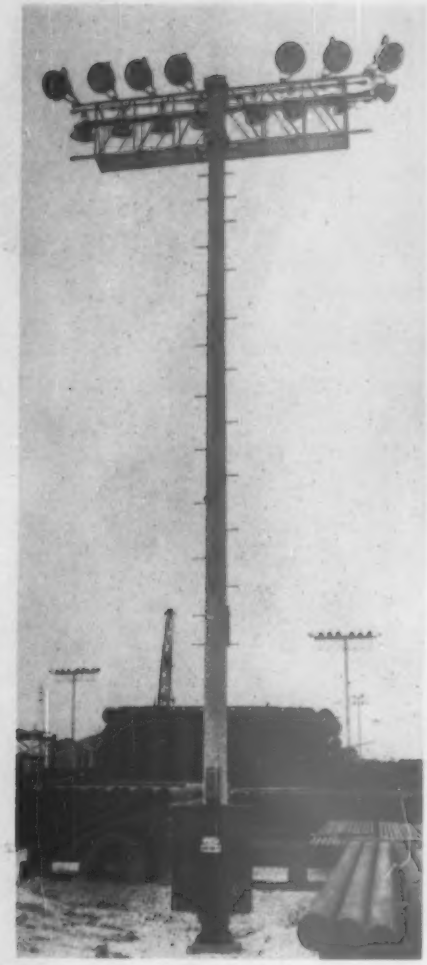
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

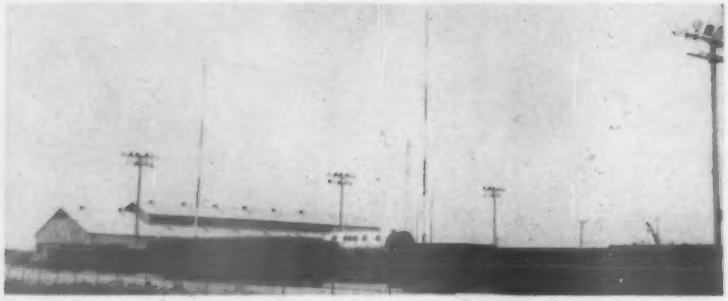
P.O. Box 1888 – Tulsa, Oklahoma

You can depend on purchased electric power for

AUXILIARIES



Electrically operated solenoid on flowing well with valve controlled by electric time-clock.



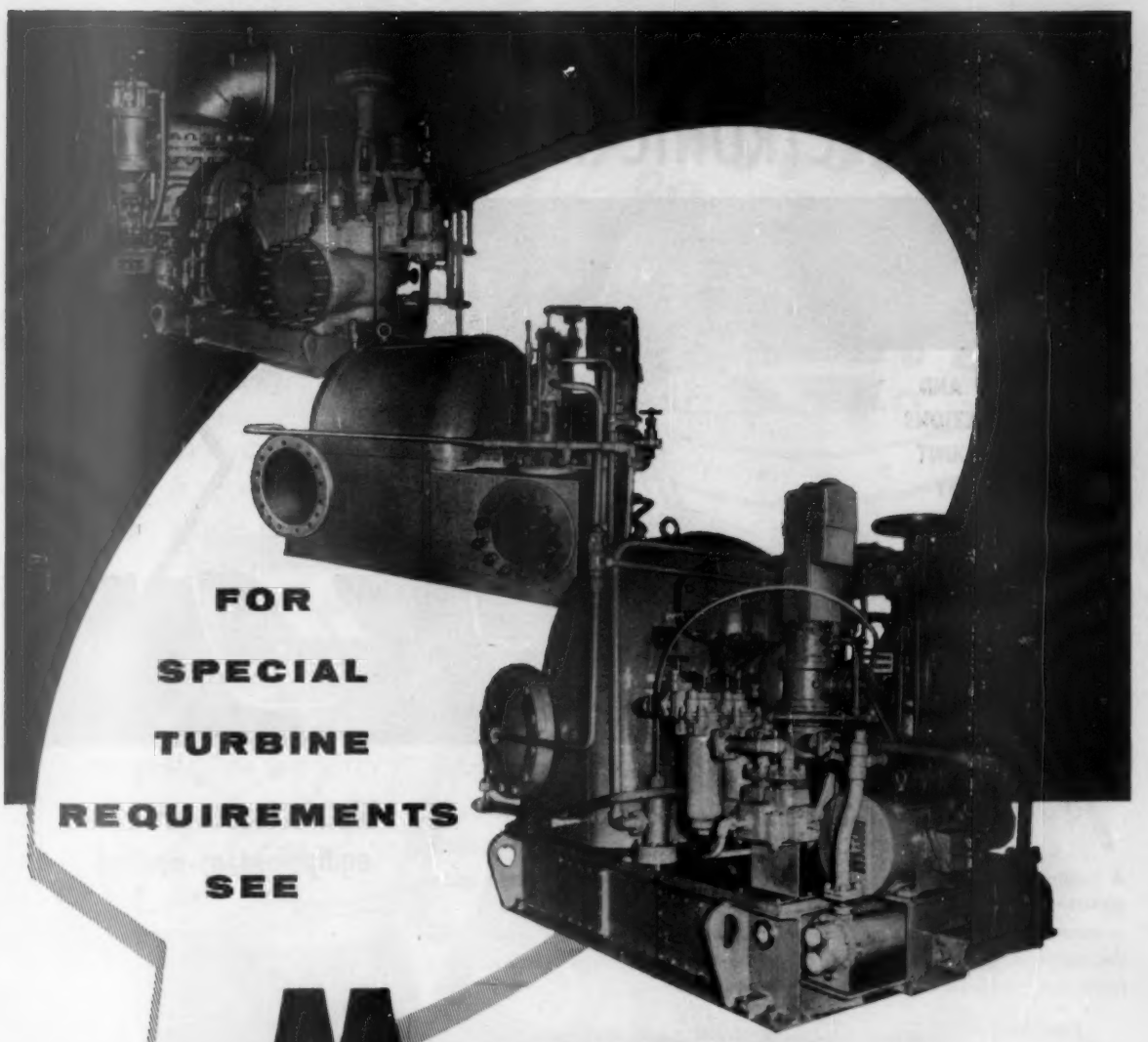
Lighting for oil company pipe storage yards and rail unloading areas.

Typical of thousands of auxiliary applications of purchased electric power... the photographs above indicate the varied use of electricity in the petroleum industry. The dependability and economy of utility electric power is fast proving the answer to many problems in oil producing, transporting and refining. Contact your nearest utility electric power company for full cooperation.

Purchased Electric Power . . .
saves money, manpower, maintenance, and serves you better automatically

Petroleum Electric Power Association

P. O. BOX 35006, DALLAS 35, TEXAS



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- Low Inlet Pressures
- High Back Pressures
- High Speeds
- Variable Speed Ranges
- Precise Control
- Multi-Valve Designs
- Double End Gear Drives
- Vertical Shaft Turbines

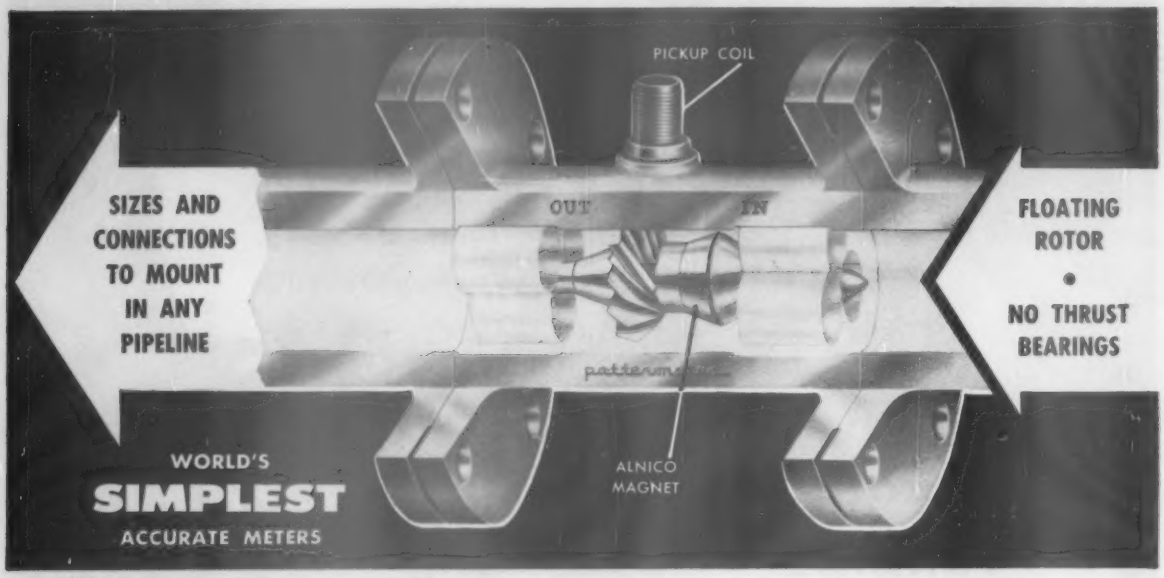
Our nearest representative will help you solve your turbine requirements. His name gladly sent on request.

MURRAY IRON WORKS COMPANY • BURLINGTON, IOWA

Builders of Steam Power Equipment for Nearly a Century

pottermeter BOWSER ESTABLISHED 1885 **0.1 GPM TO 40,000 GPM**

ELECTRONIC TURBINE TYPE METERS

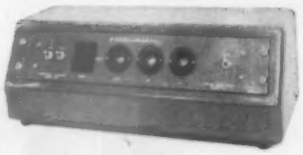


for REFINERIES

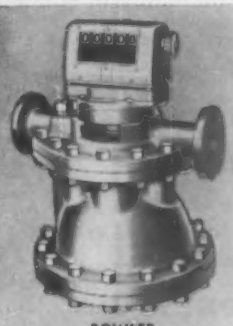
A magnet built into the turbine driven rotor generates electric current directly proportional to the flow rate of liquid in the pipe. This impulse is used to activate electronic control and readout equipment near the meter or at remote locations. Accurate over wide range of flow rates and pressures. Handles liquids and gases.

Flow Ranges	to 40,000 g.p.m. and more
Operating Pressures	Unlimited
Temperature Ranges	−455° F. to +1500° F.
Pressure Drop	Virtually Nil
Connections	No limitation
Construction (standard)	Type 316 stainless steel with Carpenter #20 Rotor

READOUT and CONTROL equipment as needed



Potter-Bowser engineers gladly confer with systems engineers to provide data on any application requirements.

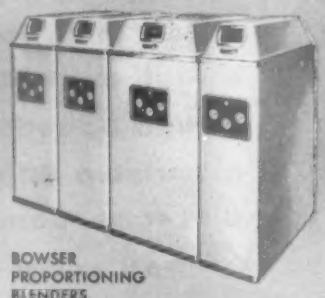


BOWSER XACTO METERS

BOWSER XACTO METERS AND PROPORTIONERS
positive-displacement piston type

Wherever mechanically driven readout and control equipment is indicated, and where positive-displacement metering is needed or costs less, Bowser Xacto Meters (leading all others in industry) are unexcelled for dependability and accuracy. Capacities: 6 GPH to 250 GPM

Xacto Meter equipped proportioners are used to blend two or more liquids in continuous flow at accuracies to ¼ of 1 percent. First in lube oil blending, Bowser proportioners also handle most other liquids used by process industries.



BOWSER PROPORTIONING BLENDERS

Write For Catalog

Potter-Bowser Division BOWSER, INC. Fort Wayne, Indiana

"FRANKLY HOPWOOD,

DON'T YOU THINK IT WOULD BE MUCH MORE PRACTICAL IF WE SENT FOR **BRIDGEPORT'S** FREE NEW BOOK— 'SOLVING CORROSION PROBLEMS IN INDUSTRY'!"

If you convey anything through condensers or heat exchangers, this 20-page Bridgeport book is must reading. It tells how to lick problems involving two corrosive media...by using bi-metal Duplex Tubes ...each metal surface designed to resist corrosion from the media to which it is exposed.

Each industry has its own corrosion problems, and this fact-packed book illustrates ways to solve many of them. For your personal copy, just write, on your company letterhead, to the Bridgeport Brass Company, Bridgeport 2, Connecticut. Please address Dept. 5706.

Bridgeport Brass Co.

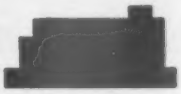
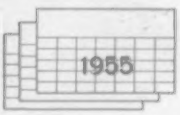
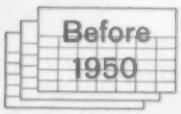
BRIDGEPORT BRASS COMPANY

Bridgeport 2, Connecticut • Sales Offices in Principal Cities

Specialists in Metals from Aluminum to Zirconium

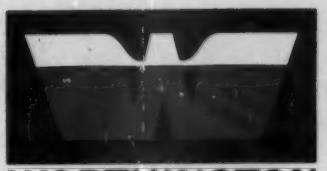
THE UNVARNISHED FACTS

about engine compressors in the 375 to 950 hp range

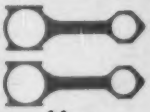
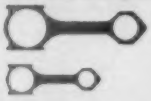
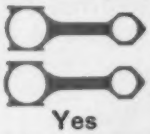
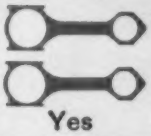
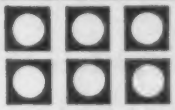
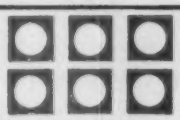
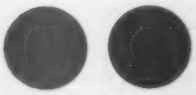
FEATURE	WORTHINGTON SLHC	MFR. A	MFR. B	MFR. C
DESIGNED FOR TURBOCHARGING	Yes	No	No	 No
SELF-SUSTAINED TURBOCHARGING	YES	NO	NO	NO
FUEL CONSUMPTION	7,000 BTU/BHP HR	9,000 BTU's	8,600 BTU's	8,500 BTU's
CYCLE	4	2	2	4
CYLINDER ARRANGEMENT	Inline	Inline	Vee	Vee
RPM	450	600	450	400
YEAR ENGINE WAS DESIGNED	 1955	 Before 1950	Before 1940	Before 1940
NUMBER OF DESIGNS TO COVER RANGE	1	2	2	2
LARGEST UNIT FOR SKID MOUNTING	950 HP	660 HP	1100 HP	660 HP

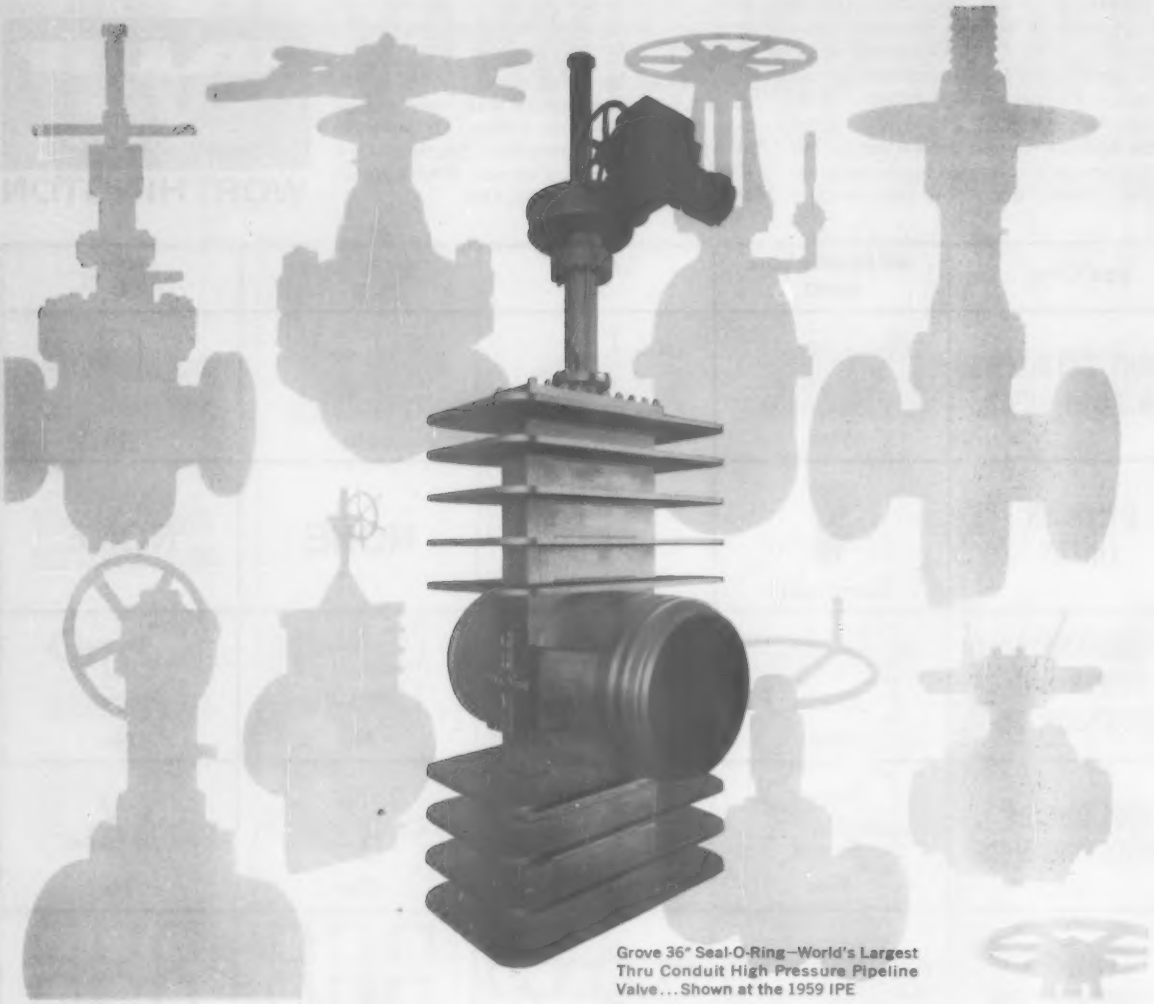
On these two pages you'll find a comparison of all the significant facts about gas engine compressors in the 375 to 950 horsepower range. We think you'll have to agree that Worthington's SLHC unit is the outstanding performer in its size range. Not only does it have 18% better fuel economy than the next nearest engine, but it also features self-sustained turbocharging, removable cylinder liners with cast-in water jacket, interchangeable power and compressor rods, and many other important engineering advances.

For complete details on the new SLHC engine compressor get in touch with your nearest Worthington district office. Or write to Worthington Corporation, Section 43-4, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantfold, Ont.



WORTHINGTON

FEATURE	WORTHINGTON SLHC	MFR. A	MFR. B	MFR. C
MOUNT CYLINDERS ON BOTH SIDES	Yes	No	No	No
CYLINDER LINERS	Removable	Removable	NONE	NONE
INTERCHANGEABLE POWER AND COMPRESSOR RODS	Yes	 Yes	No	 No
SIDE BY SIDE CONNECTING RODS	 Yes	 Yes	No	No
FRAME CONSTRUCTION	En-bloc	En-bloc	 Separate Cylinders	 Separate Cylinders
IGNITION	 Twin	Single	Single	Single
RUNNING GEAR LUBRICATION	MANIFOLD CAST IN BASE	SEPARATE PIPE MANIFOLD	SEPARATE PIPE MANIFOLD	SEPARATE PIPE MANIFOLD
GASKET-FREE CYLINDER HEAD SEATS	YES	NO	NO	NO
RUNNING GEAR EASILY ACCESSIBLE	YES	NO	NO	NO



Grove 36" Seal-O-Ring—World's Largest Thru Conduit High Pressure Pipeline Valve... Shown at the 1959 IPE

We're being imitated!

The Tulsa Show proved it. And we're glad because imitation, it's said, is the sincerest form of flattery. We enjoyed the talk about NEW Floating Seats; REVOLUTIONARY "O" Rings; AMAZING Pressure Seals and HIGHLY ADVANCED Non-Wedging Action . . . since we've had all of these things (and more) since 1953.

These "brand new" engineering-design features have been the reasons why today, Grove sells the major share of all large pipe line valves in the world. More and more valve users have recognized the operating advantages of Grove's Seal-O-Ring design. And judging from all of the "news" in Tulsa, our competition has, too.

But, imitating a design is one thing; duplicating Grove's experience or patented construction is quite another.

Grove valves—with full thru conduit; an effective metal to metal primary seal plus "O" ring cleaning and sealing action—have been proven in over 6 years' use. The "O" rings, manufactured in Grove's own rubber plant, from Grove's own formula, are completely protected in an over-sized groove. No danger of cutting or abrasion resulting from gate action. Heavy mechanical springs keep the seats in line all the time. And you never lubricate . . . See your Grove man soon. Get all the facts.

GROVE VALVE and REGULATOR COMPANY

A Subsidiary of Walworth

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HOUSTON 27—3203 Mercer St. • LOS ANGELES 6—2559 W. Olympic Blvd.

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FARMINGTON, N. M. • LAFAYETTE, LA. • HARVEY, LA. • LONGVIEW, TEXAS

In Western Canada: GROVE VALVE LTD., EDMONTON

6021

Fast help on corrosion control—A big Texas natural gas plant required periodic analyses to determine whether MEA solution was breaking down in regeneration, forming corrosive salts. Samples were being sent out of state for analysis, "took forever" to get results. Enter Allied. Now tests are run in Dallas, results come back *fast*, help this plant prevent corrosion before it can start.

New plant start-up trouble quickly traced—Slug of distillate filled inlet scrubber, carried over to amine system. Aqueous amine solution thoroughly contaminated with hydrocarbon. Customer shut down plant, was going to dump entire charge. Allied specialists diagnosed trouble as too rich amine concentration, then suggested decanting solution into empty tanks, which saved half of charge.

Foaming in glycol plant—Customer wanted to know what caused it, how to stop it. Allied specialists flew to the site, deduced cause of the trouble in a matter of hours. Lab analysis confirmed their findings. In a recommendation just five typewritten lines long, they told customer how to solve the problem completely, economically.

USE GLYCOLS OR AMINES?

ALLIED technical service is ready—right now—to help you find straight answers to knotty problems

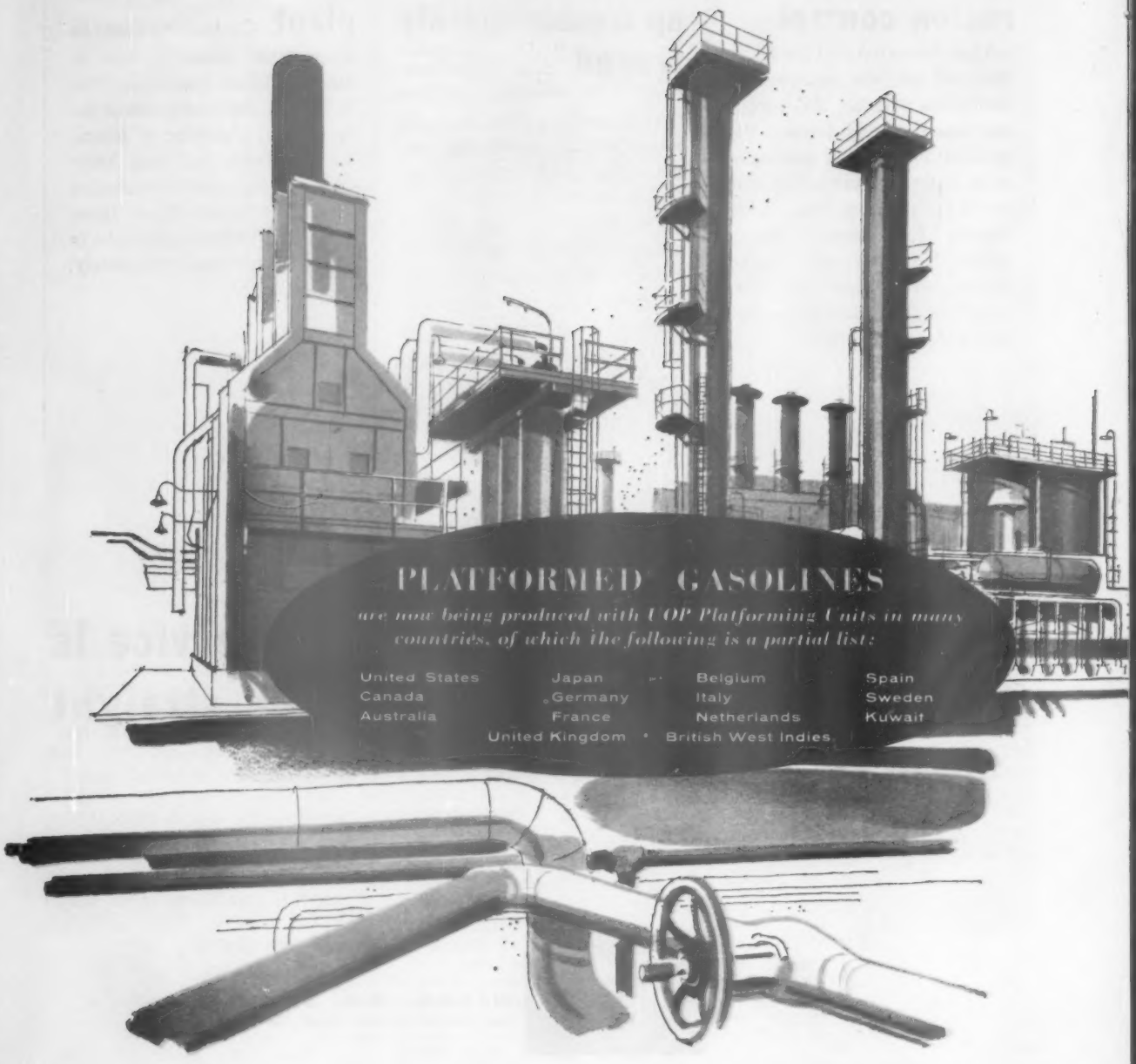
BASIC TO AMERICA'S PROGRESS

Allied Chemical

NITROGEN DIVISION
Dept. GA5-55-3, 40 Rector Street, New York 6, N. Y.

2819

1949 a decade



1959 of better gasolines through PLATFORMING®

Petroleum refiners throughout the Free World have already supplied motorists with nearly 50,000,000,000 gallons of

Platformed® Gasolines

This year marks an important anniversary . . . the anniversary of an announcement that made significant history throughout the petroleum refining industry.

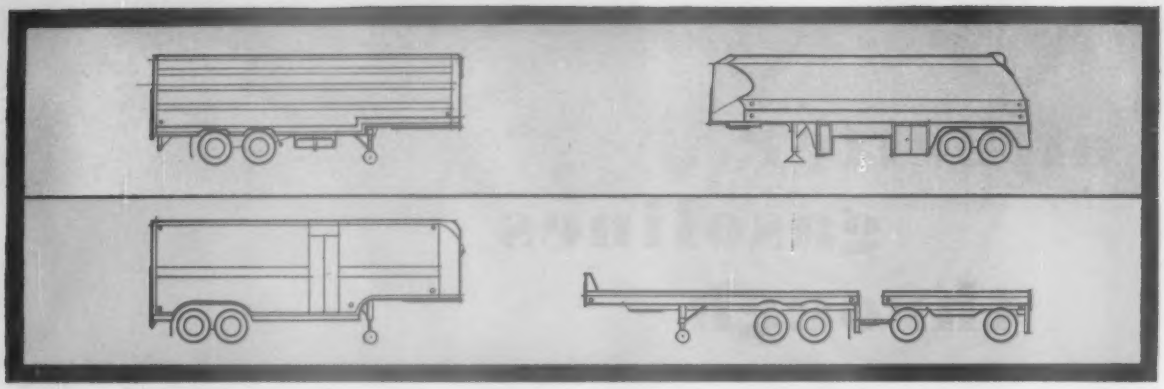
In March of 1949, Universal announced an important achievement in the field of catalytic reforming. In October of the same year, the first Platforming unit was placed in operation at a Muskegon, Michigan refinery. The new process, Platforming, literally revolutionized the entire concept of processing to improve motor fuels. It made previous methods of refining completely obsolete.

In addition to its value in producing superior Platformed gasolines, Platforming has also proved highly efficient in producing aromatic hydrocarbons, thereby providing the basis for the great petrochemical developments which have since taken place.

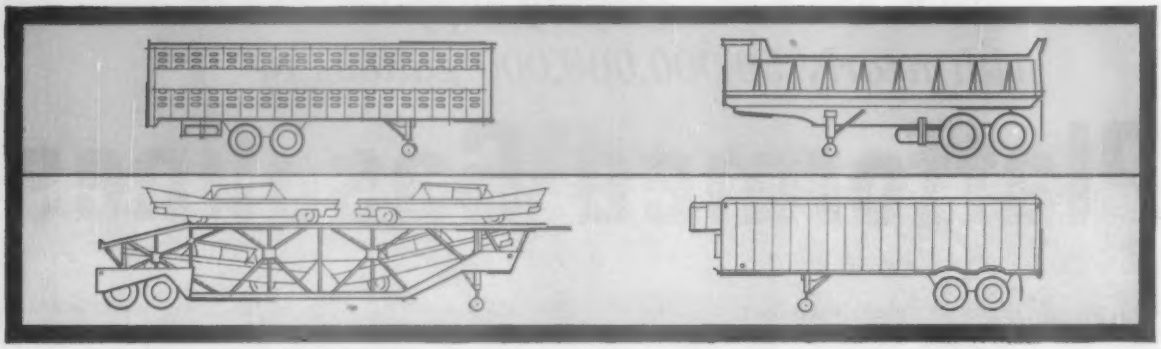
The rest of the story is a matter of history. Though many improvements and modifications have since been made, the same basic Platforming process has been applied by refiners throughout the Free World, and now accounts for a large proportion of all the reforming carried out today.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U.S.A.



MORE OPERATORS AND MANUFACTURERS SPECIFY MORE TIMKEN-DETROIT® TRAILER AXLES THAN ALL OTHER MAKES COMBINED!



Timken-Detroit Trailer Axles—the overwhelming choice of the trucking industry—are produced in the world's largest trailer axle plant. Here unmatched production, research, and testing facilities are combined with 50 years of axle building experience to bring you these outstanding advantages:

Time-proved low maintenance costs! Proven by billions of rugged service miles, Timken-Detroit Trailer Axles are famous for providing maximum safety, less maintenance and more payload.

Pioneers of light weight and strength! Weight saving is accomplished entirely through superior design and construction . . . with no reduction in strength or quality.

Imitated but never equaled! Timken-Detroit TK-500 Series Trailer Axles are still the lightest, safest, most rugged you can buy.

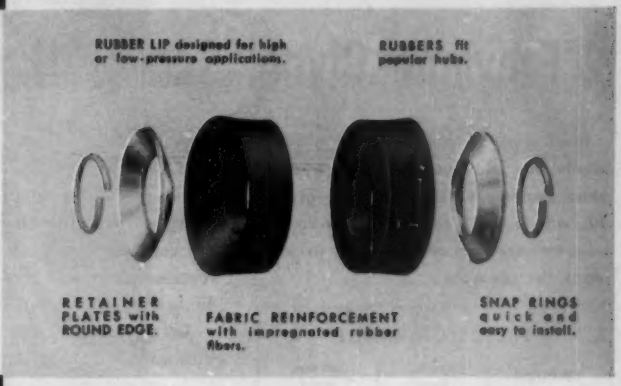
Finest quality! Part for part, Timken-Detroit Trailer Axles incorporate the finest-quality materials, precision workmanship and most advanced design.

For safe, economical operation, specify and insist upon lightweight Timken-Detroit Trailer Axles.

Another Product of... **ROCKWELL-STANDARD CORPORATION**

Transmission and Axle Division, Detroit 32, Michigan

NEW.. FORMULA-59


RUBBER LIP designed for high or low-pressure applications.
RUBBERS fit popular hubs.
RETAINER PLATES with ROUND EDGE.
FABRIC REINFORCEMENT with impregnated rubber fibers.
SNAP RINGS quick and easy to install.

GUIBERSON SLUSH PUMP PISTON RUBBERS *NOW* MEET ALL DRILLING CONDITIONS

Now Guiberson has developed a new, tough, oil resistant piston rubber compound .. specially formulated to extend piston and liner life and cut costly rig downtime.

Meeting the need for higher volumes and greater pressures, this special rubber compound is exceptional in its resistance to tearing and for its long life in pumping abrasive drilling muds.

The rubber section of Guiberson piston rubbers is firmly bonded to a heavy fabric backing for supporting maximum fluid loads. A special retainer plate with a rounded edge prevents cutting the rubber .. cause of many premature failures.

Guiberson piston rubbers are proving themselves after a year of punishing tests in the laboratory and in slush pumps on the rig. These rubbers are delivering outstanding performance through long runs under rugged drilling conditions.

Try them and see .. Guiberson rubbers are top quality .. so order them now .. start cutting expenses.

Sold by
OIL FIELD SUPPLY STORES EVERYWHERE

THE GUIBERSON CORPORATION
ESTABLISHED 1919 — DALLAS, TEXAS U.S.A.

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Ethylene Glycol Scores High As Hydrate Inhibitor

In refrigeration-type gasoline recovery plants, the most widely used hydrate point depressant is diethylene glycol. But, ethylene glycol may offer certain advantages as a replacement in your plant, for example . . .

SELECTION GUIDE

ADVANTAGE	Ethylene Glycol	Diethylene Glycol
Hydrate Inhibition	GOOD	GOOD
Ease of Separation	BETTER	GOOD
Cost	LOWER	—
Vaporization Loss	LOW	LOWER
Solubility Loss	LOWER	LOW

HYDRATE INHIBITION

While both ethylene and diethylene glycol give good hydrate inhibition, with hydrate point depressions generally in the range of 60° to 80°F., reports indicate that ethylene glycol may give a greater depression in those cases needing very low separation temperatures.

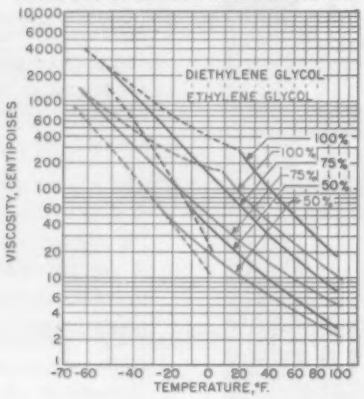
EASE OF SEPARATION

Ethylene glycol-water solutions are easier to separate at very low temperatures than diethylene glycol-water solutions.

This advantage is illustrated in the graph below. At 0°F. the viscosity of a 50 per cent ethylene glycol solution is 20 centipoises, or half the viscosity of the diethylene glycol solution.

An even more marked difference is shown at lower temperatures . . . at—40°C. a 75 per cent ethylene glycol solution has a 300 centipoises viscosity, as compared with 1000 to 2000 for a 75 per cent diethylene glycol solution.

VISCOSITY OF GLYCOL-WATER MIXTURES



COST

Ethylene glycol costs 1¾¢ a pound less than diethylene glycol which means a possible tank car savings of $1,300.

VAPORIZATION

Although ethylene glycol vaporization losses are greater than diethylene glycol's, the difference is insignificant below 30°F., if separator pressure is 750 PSI or higher.

SOLUBILITY

At separation temperatures of 60°F., glycol losses due to solubility should be in the range of 10 to 50 ppm when 50 to 75 per cent ethylene glycol solutions are used; and 20 to 100 ppm with equal strength diethylene glycol.

The higher volatility of ethylene glycol must be taken into consideration in regeneration equipment design and operation; but ethylene glycol may offer advantages in certain systems. Your CARBIDE Technical Representative can show you data on the pros and cons of ethylene or diethylene glycol hydrate inhibition in your system.

For a copy of a new report, "The Glycols as Hydrate Point Depressants in Natural Gas Systems" and a comprehensive bibliography of all the major articles published on gas sweetening and dehydration in the last 25 years, use the coupon.

UNION CARBIDE *is a registered trade mark of Union Carbide Corporation.*

UNION CARBIDE CHEMICALS COMPANY, Rm. 328, Dept. G, 30 E. 42nd St. New York 17, N.Y.

Please Send Me

- ☐ Technical data report—"The Glycols as Hydrate Point Depressants in Natural Gas Systems."
- ☐ 15-page Gas Sweetening Bibliography.
- ☐ Please have a CARBIDE Technical Representative call.

NAME: ..... POSITION: .....

COMPANY: .....

ADDRESS: .....

CITY: ..... STATE: .....

UNION CARBIDE CHEMICALS COMPANY

DIVISION OF

UNION CARBIDE CORPORATION

AE·Lenkurt

HAS EVERYTHING YOU NEED FOR SYSTEM-WIDE COMMUNICATIONS

LENKURT LONG-HAUL CARRIER, for instance...

Where distance is a problem, the Type 32E Carrier Telephone System is one of the Lenkurt systems available as a solution. It is an economical and efficient means of adding communication channels to existing wire lines.

Type 32E single sideband suppressed carrier terminals are equipped with either three or four channels in the 3-kc. to 35-kc. range, and can be applied over v-f circuits. With the use of repeaters, these channels can be used for high quality, medium- and long-haul circuits. System levels and frequencies coordinate with those used in Western Electric Type C carrier equipment.

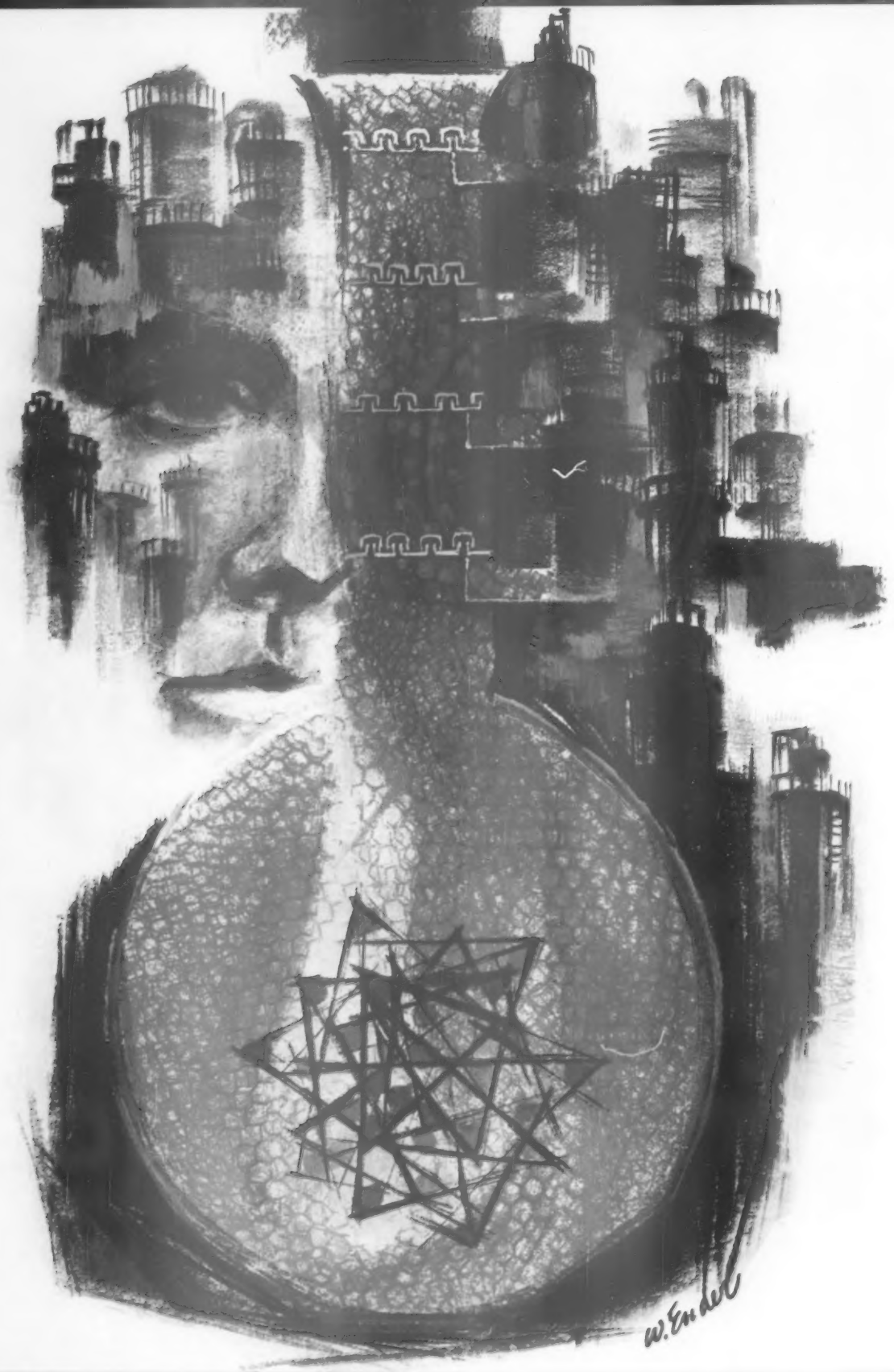
The AE-Lenkurt team of engineers is equipped to handle as little or as much of the planning and installation as you wish. And AE will provide "follow-thru" service *for the life of the equipment.*

For full information on the Lenkurt Type 32E or companion equipment, call your Automatic Electric representative, or write the Director, Petroleum Sales, Automatic Electric Sales Corporation, Northlake, Illinois.

ALL YOUR COMMUNICATIONS NEEDS
FROM ONE
DEPENDABLE SOURCE

AUTOMATIC ELECTRIC GENERAL SYSTEM

Subsidiary of
GENERAL TELEPHONE & ELECTRONICS



CLARK

CLARK BROS. CO.
compressors and
gas turbines

DRESSER DYNAMICS

DRESSER DYNAMICS DIVISION
advanced scientific research

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DRESSER-IDECO COMPANY
steel structures
and buildings

DRESSER
MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION
couplings and rings

THE GUIBERSON CORPORATION
oil tools, molded
rubber products

Hermetic Seal Transformer Co.

HERMETIC SEAL TRANSFORMER CO.
electronic transformer
development-manufacture

IDECO Inc.

IDECO, INC.
complete drilling rigs

Aglow with brilliant colors symbolizing an almost endless variety of processed chemicals, a large flask, at left, reflects the atmosphere of its refinery background. Dresser Industries, by improvement of existing lines and development of new equipment, have made many contributions to the progress of the refining and processing industries. Dresser companies provide superior products and technical services which have long been known as the standard of comparison the world over.

LANE-WELLS COMPANY
technical oilfield services

Magcobar
MAGNET COVE BARIUM CORP.
drilling mud and chemicals

PACIFIC
PACIFIC PUMPS, INC.
pumps of various types

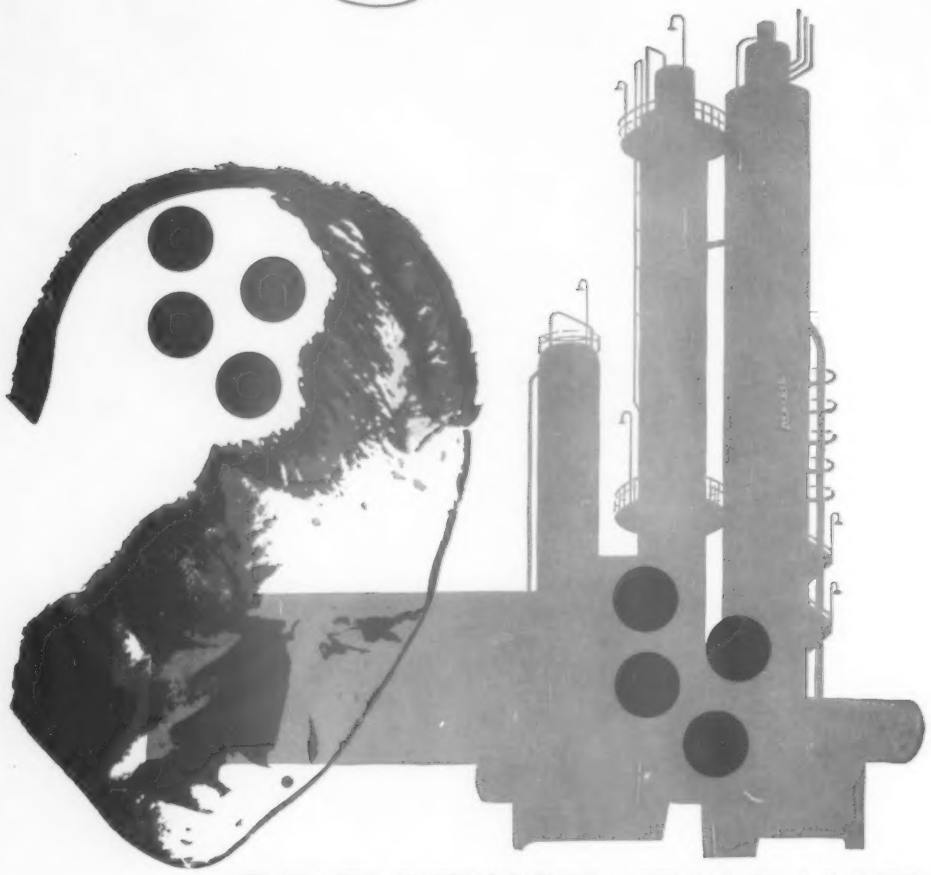
ROOTS-CONNERSVILLE BLOWER DIVISION
blowers, meters, vacuum pumps

Security
SECURITY ENGINEERING DIVISION
rock bits and oilwell drilling tools

SIE
SOUTHWESTERN INDUSTRIAL ELECTRONICS
seismic and electronic instruments

WELL SURVEYS
WELL SURVEYS, INC.
nuclear and electronic research

intangibles were never so **important**



CREATIVE ENGINEERING

High on the list of intangibles included in Procon construction service is what may well be termed "creative engineering". Covering every detail of the design and engineering of all processing units and auxiliary equipment, it is provided by an unusually well-organized, closely knit team of engineers and draftsmen. As a result, a Procon-built plant can be depended upon to perform with precision—to extract from every barrel of feed stock every last drop of finished product and every last penny of profit.

PROCON

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA

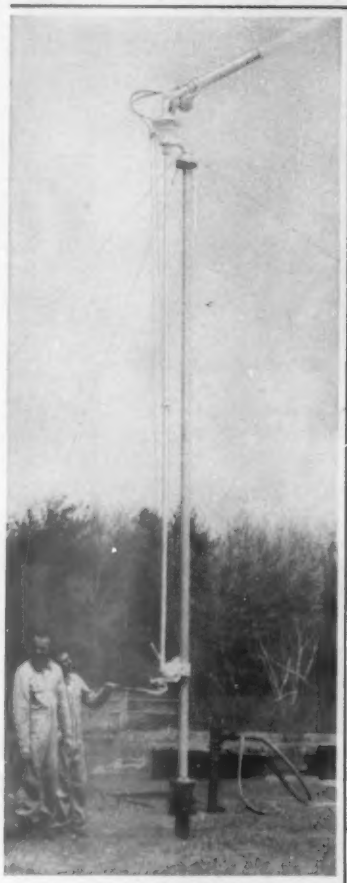
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND

PROCON INTERNATIONAL S. A., SANTIAGO DE CUBA

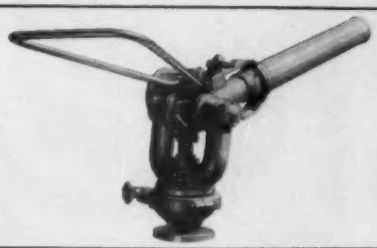
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

Most Complete Line of Specialty Turrets on the Market!

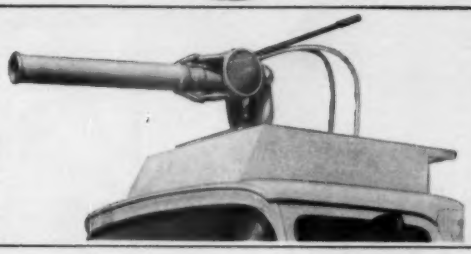
...All Rockwood Turrets Discharge FogFOAM
Solid FOAM Stream — WaterFOG — Solid Water Stream



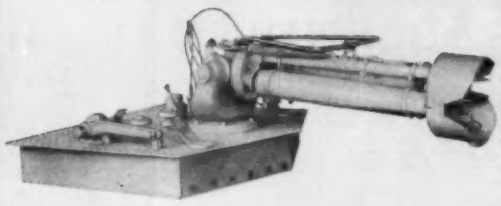
Extended Manual Control Type — Turret nozzles extend 10 to 20 feet above remote control station on deck or ground on standard units . . . greater remote extensions for special applications.



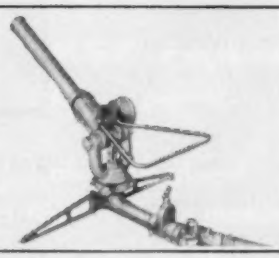
Direct Manual Control Type — Gives fire fighters "out-in-the-open" control from cab roof!



Remote Manual Control Type — Easily handled by man in driver's seat. Ideal for fast action!



Remote Hydraulic Control Type — Power-controlled from within the cab. Single and dual models. Widely used on air crash rescue fire-fighting trucks.

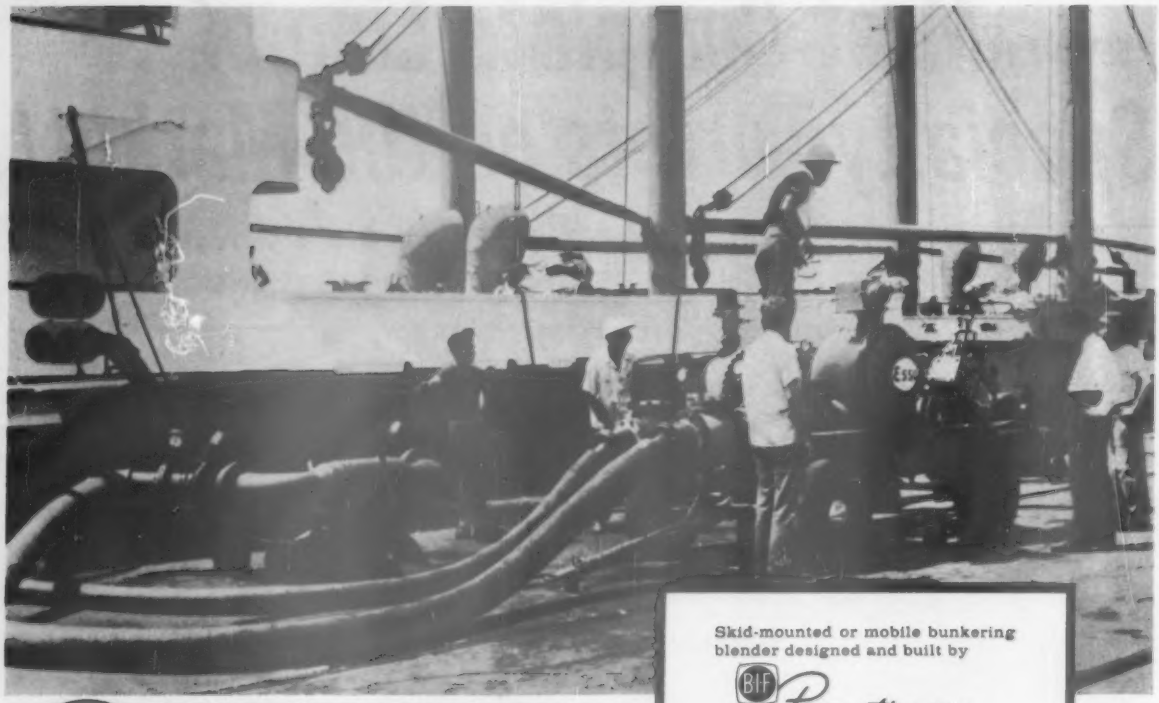


Portable Type — Off the truck and into action in seconds! Goes wherever a fire fighter can bring the proper hose line into action!

On the truck or on the ground, fire fighters can hit fires *harder* using ROCKWOOD Turrets! At airports and refineries . . . in municipalities and throughout industry . . . these advanced-design fire-fighting aids are constantly proving their ability to extinguish fires faster.

ROCKWOOD Turrets provide plenty of volume *and* versatility. What's more, all are easily adjustable on the fire line to meet changing fire conditions. Produced by the world's largest manufacturer of specialty Fire-Fighting Turrets, they're designed to give fire fighters an extra edge of efficiency on most types of fires. Get full details on the complete line of fire-fighting products. Write ROCKWOOD SPRINKLER COMPANY, Portable Fire Protection Division, 484 Harlow Street, Worcester 5, Massachusetts.

ROCKWOOD SPRINKLER COMPANY
A Division of The Gamewell Company
Engineers Water ... to Cut Fire Losses
Distributors in all principal cities.



Everywhere—BRODIE is linked with Progress.
Here's another example from Cristobal, Canal Zone.

BUNKERING/BLENDING with BRODIE BiRotor METERS

B.I.F Proportioneers, leading engineering designers and builders of systems and equipment for positive control of petroleum products, rely on dependable Brodie *BiRotor* Meters for many of their unique, custom-built installations. Whether it's a versatile mobile bunkering blender, pipeline, refinery or marketing application, Brodie *BiRotor* Meters are noted for high sustained accuracy and low maintenance.

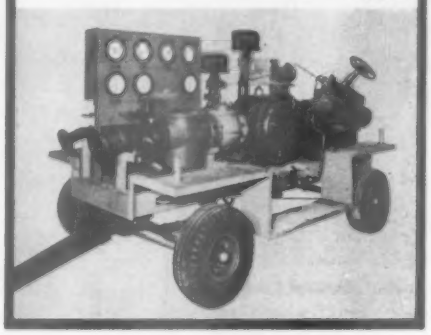
In every bulk transfer operation – from wellhead to truck-tank delivery–you never have to "baby" a Brodie *BiRotor* Meter. It's safe to operate at full rated capacity. Whatever your metering need, call your nearby Brodie Metering Specialist!

912

Skid-mounted or mobile bunkering blender designed and built by

BIF Proportioneers

utilizing Brodie *BiRotor* Meters. Compact unit provides positive control at dockside for fast accurate bunkering of ships.



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San Leandro, California, U.S.A.
CABLE ADDRESS: "BRODICO"

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BiRotor METERS

REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

Spotlighting 2 NEW VOGT VALVES

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FORGED STEEL

INSIDE SCREW

Bolted Bonnet

GENERAL GP PURPOSE

GATE and GLOBE

VALVES

150-800 Pounds Service

2000 Pounds Cold, W.O.G.

Available from stock in ¼" thru 2" sizes, and in both socket weld and screw ends.

CHECK THESE FEATURES

1. Forged steel pressure containing parts designed for light weight and brute strength.
2. Hard faced seats and hardened discs and wedges.
3. Spiral wound stainless steel or Monel gaskets to suit trim.
4. Extra deep stuffing box for long packing life.
5. Dished sure-grip handwheel.

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HENRY VOGT MACHINE CO., LOUISVILLE, KY.

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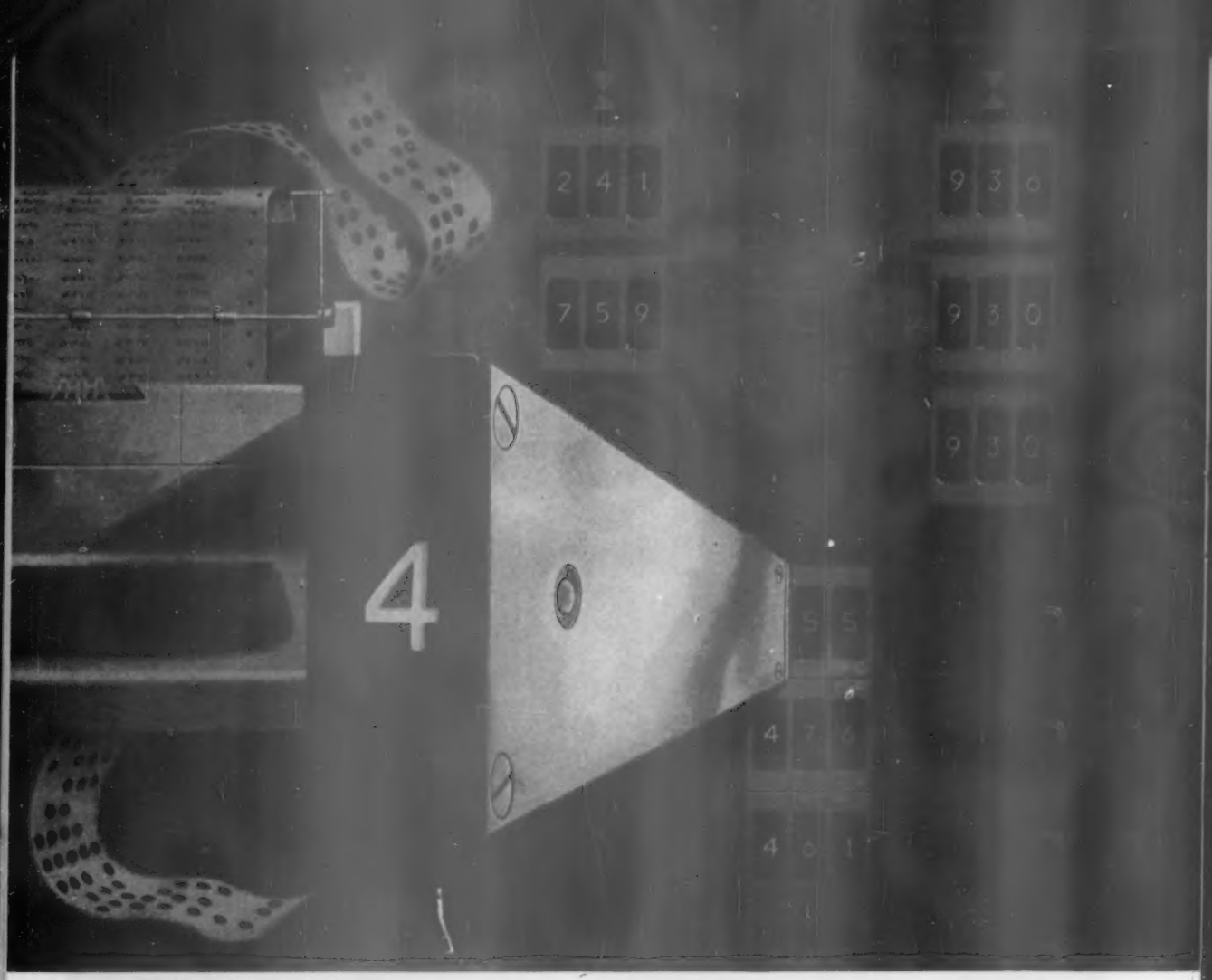
Vogt GENERAL GP PURPOSE Vogt FOR BETTER VALVES & FITTINGS

FORGED STEEL

VALVES



NEW CONTROL CONCEPT
can cut your pipeline costs

Did you ever try to solve a jigsaw puzzle without first looking at the total picture the puzzle makes? Pretty difficult—maybe even impossible. Best way, easiest way is to look at the big picture first, then see where the individual pieces fit.

It's the same with pipeline control.

First, look at your total system problem. Then, determine what sort of control system is required to safely, reliably and economically meet tomorrow's need as well as today's. That is Union Switch & Signal's approach to pipeline control.

Any part of a pipeline system. Union Switch & Signal can incorporate in a centralized control system any or all of the following functions: supervisory or remote control of satellite stations . . . telemetering of flow data from field back to your central dispatching office . . . automatic sequencing or control of equipment in the field . . . instrumentation . . . data handling and display . . . computing equipment . . . automatic integration of field data into your accounting operations . . . communications. Union Centralized Transport Control can be adapted to *any* problem from remote control of a single-unit booster station for gas or oil to automatic centralized control of an entire system from wellhead to ultimate consumer.

Error-free. Whatever the job assigned to it, Union Centralized Control operates completely free from error because it reduces to coded digital form all information and instructions transmitted to or from your central control office. As a result, you can transmit far more precise data than ever before; you can use the least expensive available communications service; and you never need to worry about lightning, noise or other interference causing a wrong or dangerous operation—this coded system automatically checks itself and responds *only* to correct and logical signals. It helps make your pipeline safer. It provides error-free *security* as well as reliability.

Lower operating cost. Most important, Union Centralized Transport Control cuts your operating costs, cuts the cost of future expansion, sometimes even cuts present installation cost of pumping stations.

Write for Bulletins PD 2006, PD 2007 and 1052

"Pioneers in Push-Button Science"

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 18, PENNSYLVANIA

ENGINEERED APPLICATION of pumping systems means getting the right pump to do your liquid-handling job most efficiently.

Meaning? You must choose from a wide variety of pump designs, sizes, materials, performance characteristics. You need to know what special pumps handle acids, paper stocks, corrosive alkalies, salt water, slurries.

Impossible? Not for an expert. And Goulds provides the expert every time you need a pump. Goulds' application engineers specialize in every pump field to help you select *just* the pumping system you need.

The next time you're faced with a decision on what pump to buy, call in a Goulds man to look the problem over. He'll cut corners where he can, but make no sacrifices of quality or safety. And when he says, "This is it!" you can *depend* on it.

For help in solving *your* pumping problem, write to: Goulds Pumps Inc., Dept. OG-109, Seneca Falls, N. Y.

GOULDS GP PUMPS

NOW... Hammond TUBESEALS

Guaranteed for storage of HIGH AROMATICS

HERE'S GOOD NEWS FOR PRODUCERS AND HANDLERS OF HIGH AROMATIC CHEMICALS

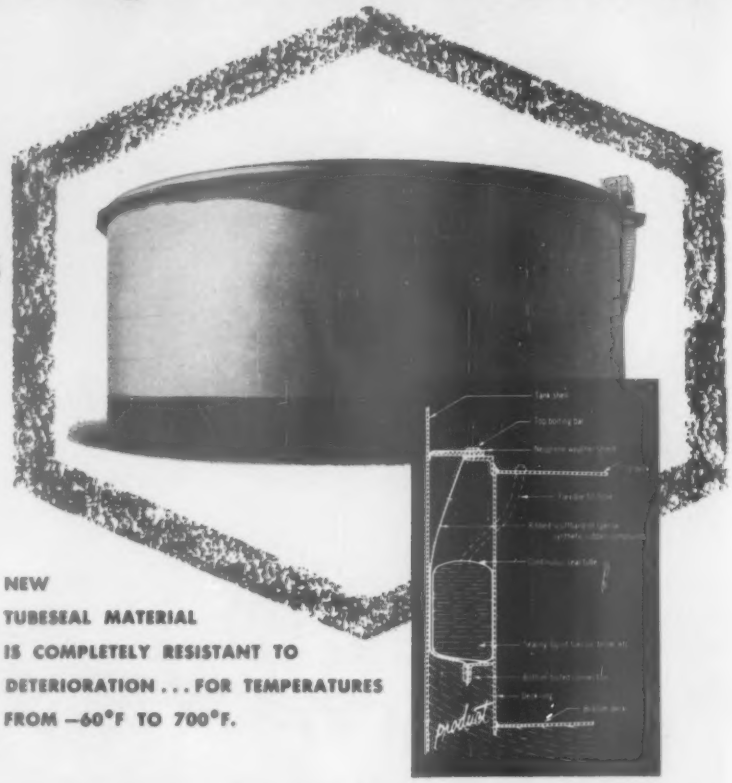
Elimination of evaporation losses and protection against product contamination of high aromatics in storage is now possible with the new Hammond Tubeseal System* for floating roof tanks. The new tubeseal material overcomes deterioration problems experienced with other sealing materials. Hammond Tubeseals are guaranteed for storing products containing 75% aromatics and for a wide range of other difficult liquids.

A Hammond Floating Roof Tank, with the new aromatic-resistant Tubeseal System, is the answer to liquid storage of high aromatics . . . and the Tubeseal Floating Roof can be installed on new or used tanks of riveted or welded construction.

ELIMINATE LIGHTNING FIRES:

The Hammond weathershield, a standard part of the Hammond Tubeseal System, is completely electro-conductive to eliminate the possibility of lightning fires.

Send us the details on your storage facilities and requirements. We will be glad to offer you the benefits of more than 50 years of liquid storage experience.



NEW TUBESEAL MATERIAL IS COMPLETELY RESISTANT TO DETERIORATION . . . FOR TEMPERATURES FROM –60°F TO 700°F.

INCLUDED AMONG THE AROMATICS AND OTHER CHEMICALS WHICH CAN NOW BE STORED IN HAMMOND TUBESEAL FLOATING ROOF TANKS ARE:

- ISOPROPYL ETHER
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- ALLYL CHLORIDE
- HEXALENE GLYCOL
- ETHYL ALCOHOL
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- ETHYL GLYCOL
- BENZENE
- CREOSOTE OIL (CREOSOL)
- TOLUENE
- NAPHTHA and HYDROGEN SULFIDE
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- XYLENE
- BUTYL ALCOHOL
- SULPHURIC ACID 95%
- METHYLENE CHLORIDE
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- ETHYLENE DICHLORIDE
- BENZYL ALCOHOL
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*Patented

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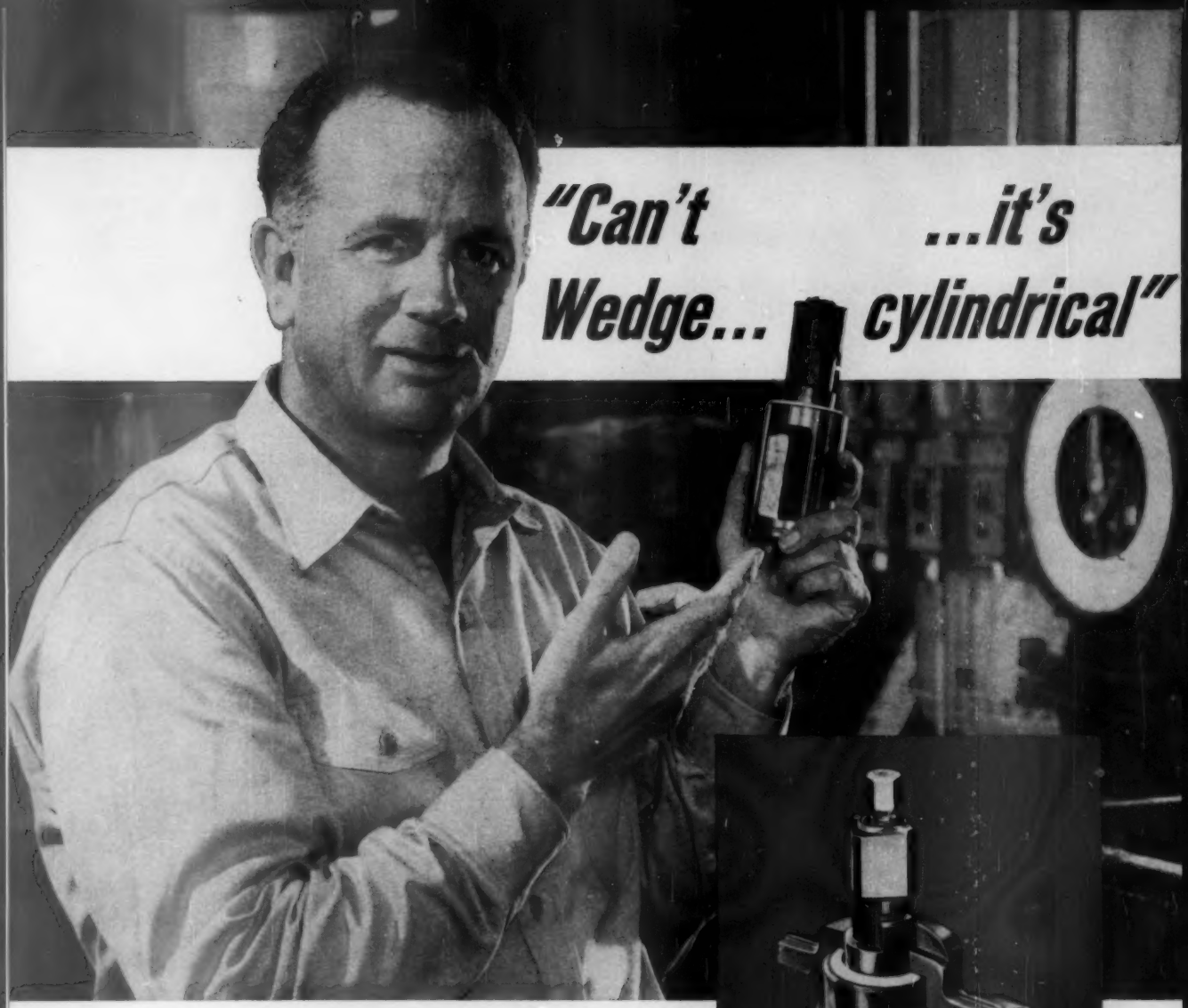

"Can't Wedge... ...it's cylindrical"

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Lubricated Plug Valves

There's no taper to cause sticking or wedging in an ACF valve. And the plug can't be unseated.

The baseplate spring and line pressure hold the plug tight against the Teflon head seat gasket. All friction surfaces are constantly lubricated for easy quarter-turn operation and protection against corrosion.

Next time — and every time — specify ACF! *Available from leading suppliers everywhere.*

Product of W-K-M's *Creative Engineering*

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ACF semi-steel lubricated Plug Valves are available in rectangular, round, diamond, and V ports; venturi, multiport and steam-jacketed models.

Materials: steel, semi-steel, Ni-resist, carbon steel, bronze, aluminum.

Sizes: ½" through 30".

Working Pressures: 125 through 800 pounds.

5710

. . . DRY JET FUELS

Jet aircraft now get a new and wider safety margin when their fuels are dried with LINDE Molecular Sieves. Even at high fuel flow rates, water normally absorbed at ground level is reduced to less than 10 ppm—eliminating ice-blocked fuel lines at high altitudes.

Liquids never before dried-successfully by desiccants can now be dried commercially with these new zeolite adsorbents. Examples are acetone and other ketones, ethanol and other alcohols, and most saturated and unsaturated hydrocarbons. Drying to less than 1 ppm is now practical in dynamic systems. Due to their high water adsorbing capacity, LINDE Molecular Sieves bring pronounced savings in investment and operating costs.

No matter what the liquid—whether attempts to dry it have succeeded or failed—we would like to discuss with you what a Molecular Sieve design can do.

Write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Address Dept. O-101

Linde MOLECULAR SIEVES

UNION CARBIDE

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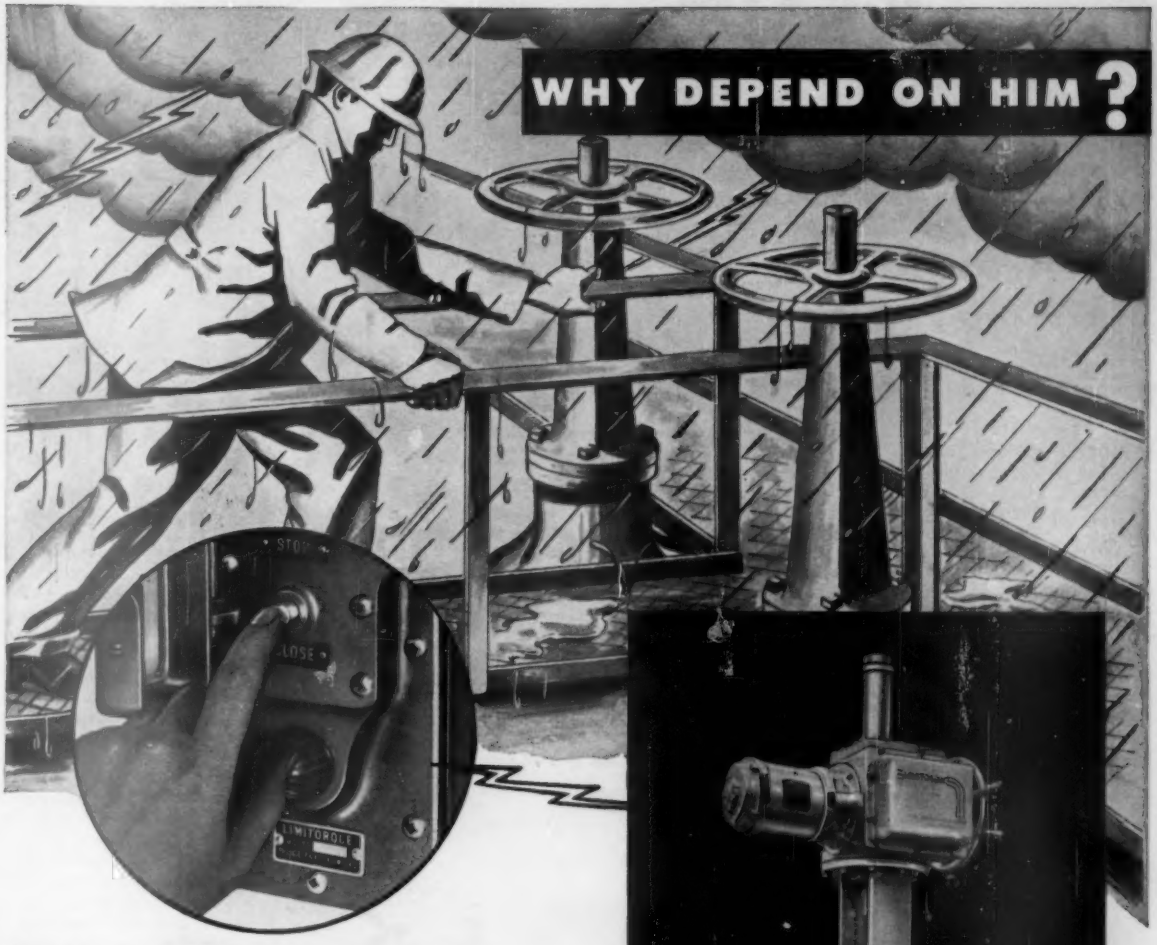


LimiTorque

WILL DO IT THE EASY, SAFE WAY

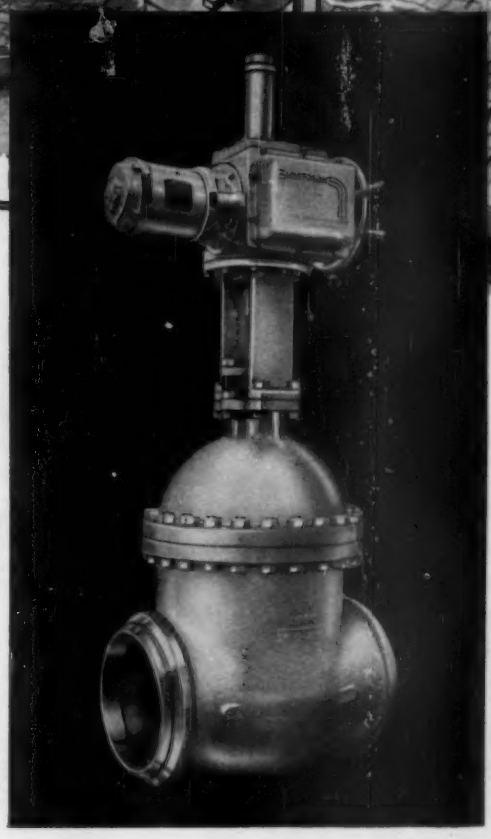
Whether hand operating conditions of valves involve snow, ice, slush, high winds, torrential rains, high temperatures and dust storms, or climbing to high, inaccessible and hazardous valve locations—LIMITORQUE PROVIDES COMPLETE SAFETY TO WORKMEN, *because it operates valves automatically by the "mere push of a button", from a centrally located panel-board* . . . and, what is also vitally important, LIMITORQUE PROTECTS VALVE OPERATING PARTS by a torque limit switch, which instantly shuts off the motor if obstructions are met during valve operation. . . . *Yes, it will pay you to equip your hand-operated valves with LimiTorque Motorized Valve Operators.*

Thousands of valves of all types throughout the world are operated day-in and day-out by LimiTorque Controls, at just the correct speed desired—safely and dependably.

LimiTorque is available for actuation by any power service: Electricity, Oil, Gas, Water, or Air . . . and, if desired, can be equipped for Micro-Wave Control.

Contact your Valve Manufacturer, or your nearest LimiTorque Sales Engineering Office.

Send for Catalog L-550 and please use your Business Letterhead.



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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS

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BALANCED DENSITY

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Davison *balanced density catalysts* save you dollars. Davison balances density against particle size distribution and catalytic stability, with all the precision of a tightrope walker to give you maximum activity maintenance and regeneration efficiency.

Here is why. Controlled pore size results in lower air consumption per unit of coke burned —lower residual carbon—lower CO_2/CO— greater resistance to thermal deactivation. Write Dept. 40210 now for your copy of Davison Product Service Bulletin No. 59-104.

Department 40210

W.R. GRACE & CO.

DAVISON CHEMICAL DIVISION

BALTIMORE 3, MARYLAND

What's their line?

VICE-PRESIDENT, CHAMBER OF COMMERCE
James Duncanson (left) of Byron, Michigan (with L. W. Small, Village President)
Business_____?

...Here are seven outstanding citizens. Can you guess the business each is in?

Banker? Doctor? Architect? Editor? All wrong! But here's a hint. They are all in the same business. And you will find them occupying positions of responsibility and trust in communities throughout the Midwest and Rocky Mountain states.

Give up? They are all Standard Oil dealers.

We wish we could show you all the Standard Oil dealers who are doing distinguished civic jobs for their communities. But we can't. The total actually runs into the thousands.

These seven dealers are representative of those thousands who serve their friends and neighbors both on and off the job.

They are independent businessmen who have won success in a highly competitive business with their friendliness and helpfulness. And, as members of Standard Oil Dealer Advisory Councils, they give us their expert advice on motorists' needs so we can further improve our service to you. Overall, there are 54 dealer advisory councils. They meet regularly with Standard's management to discuss ways to give you better service.

Standard Oil dealers have grown and prospered as the demand has increased for Standard's high-quality, always-dependable products. Here in mid-America, where you see the familiar Torch and Oval sign, they serve far more motorists than do any other group of dealers.

We think it is no coincidence that so many Standard Oil dealers are outstanding citizens, looked to for leadership in their own communities... because their kind of service is never bounded by dollars or hours.

WHAT MAKES A COMPANY A GOOD CITIZEN?
We all know what makes a *person* a good citizen. One measure is his contribution to the stability and progress of his community. The same yardstick can be used for companies, too. *If a big company's policies help small, independent businessmen to grow and prosper,* that company is fulfilling one of the most important duties of a good business citizen.

SCHOOL BOARD MEMBER
Dyas Neill of of Ft. Morgan, Colorado
Business_____?

BOY SCOUT COUNCIL LEADER
R. H. Mohnsen of Michigan City, Ind.
Business_____?

YMCA BOARD MEMBER
Herb Jensen of Ottawa, Illinois
Business_____?

SCHOOL BOARD MEMBER
Bill Reed of Spirit Lake, Iowa
Business_____?

VILLAGE TRUSTEE
Charles Donahue, Whitefish Bay, Wis.
Business_____?

PRESIDENT, CHURCH MEN'S CLUB
Larry Gaida of Duluth, Minnesota
Business_____?

100th ANNIVERSARY OF THE OIL INDUSTRY
1959
75th ANNIVERSARY OF STANDARD OIL CO.

STANDARD OIL COMPANY
(INDIANA)

STANDARD
THE SIGN OF PROGRESS... THROUGH RESEARCH

POWELL
FOR CORROSION RESISTANT VALVES

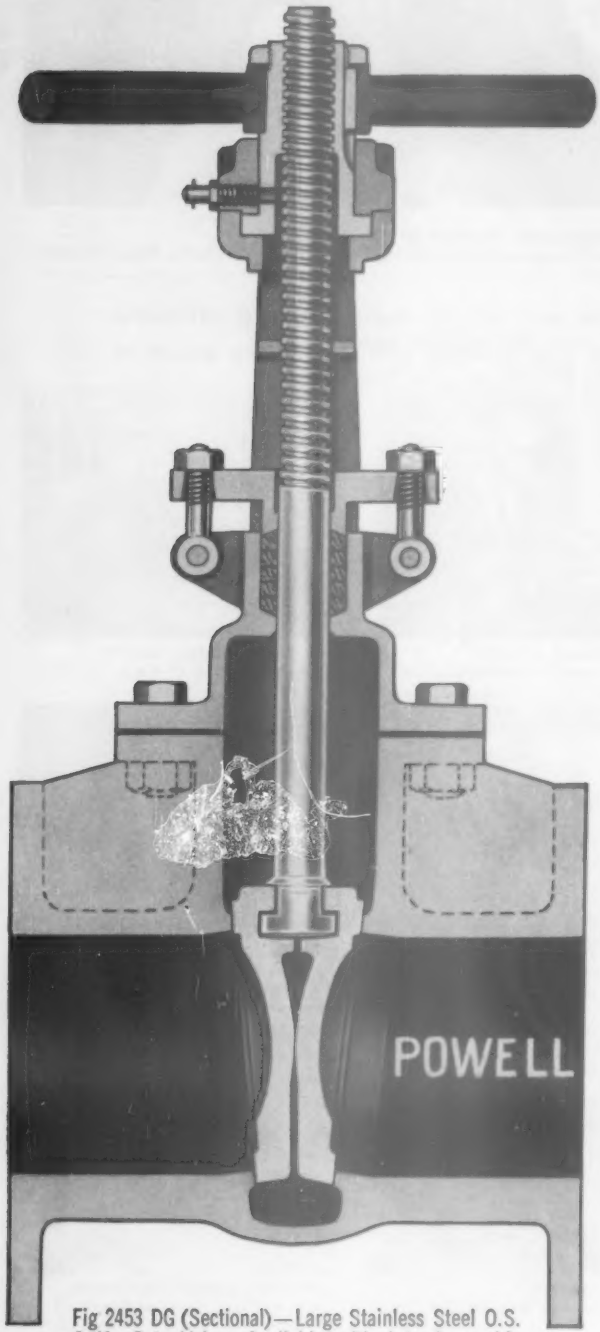

Fig 2453 DG (Sectional)—Large Stainless Steel O.S. & Y., Gate Valve. Available with interchangeable solid or split wedges. Wedges are fully guided throughout their travel.

Fig. 2633—Large, Stainless Steel Swing Check Valve for 150 W.P. Sizes, 2" to 12".

Powell offers valves available in the largest selection of metals and alloys to handle practically every corrosive fluid—valves that can be depended upon to control flow in most severe services—because of

Powell advanced design and engineering.

Solid and double wedge discs of gate valves are interchangeable. They are precision machined and fitted, and are accurately guided throughout their entire travel. This prevents drag of the disc over the seat faces, eliminating wear of seating surfaces and stops undue vibrational noises.

O.S. & Y. Valves—Stems are threaded and guided through a bronze bushing in upper yoke. (Bushings made of other alloys can be supplied on special order.) A compression lubricant fitting in upper yoke is provided to lubricate the stem and bushing threads and to reduce wear. A convenient shelf is cast on the inner sides of yoke arms for suspending the gland when renewing the packing.

All 150# valves are regularly packed with Teflon Packing. Globe, Angle and "Y" valves are available with metal or Teflon discs.

Globe, Angle, Gate and "Y" valves are back seated for repacking under pressure when fully open.

Consult your local Powell distributor or write directly to us.

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

More **protection in depth** from Liberty Mutual

Explosion-proof lights make night drilling safer in presence of combustible gases. Liberty engineers and research specialists constantly seek new devices and methods to reduce drilling hazards, lower compensation insurance costs.

Spotlighting safety on the night tour to lower your compensation costs

Doing specialized completion work after dark might well save on operating costs. *It might also mean disaster and ruin.*

Liberty Mutual's experienced loss prevention engineers work with policyholders to establish extra safeguards to control the risks when extra-hazardous operations like drill stem testing must be performed at night.

To safeguard your drilling crews and lower your workmen's compensation costs, Liberty engineers help you build safety into your 24-hour operations as a part of protection in depth. At night particularly, each man should know his assignment at blowout. Equipment like lighting systems should be checked frequently, materials handling hazards reduced, good housekeeping standards maintained.

Protection in depth includes many other extra services to help you lower your insurance rates: an accident research center, a medical advisory system and two rehabilitation centers to help get injured personnel back on the job fast if accidents do happen.

Protection in depth has plenty to offer you, whether your drilling operations consist of one or a dozen rigs. If you're interested in keeping your costs for workmen's compensation insurance at a minimum, call the Liberty Mutual salesman in your area.

Look for more from

LIBERTY MUTUAL

...the company that stands by you

LIBERTY MUTUAL INSURANCE CO. • LIBERTY MUTUAL FIRE INSURANCE CO. • HOME OFFICE: BOSTON

Business Insurance: Workmen's Compensation, Liability, Group Accident and Health, Fire, Fleet, Crime, Rig
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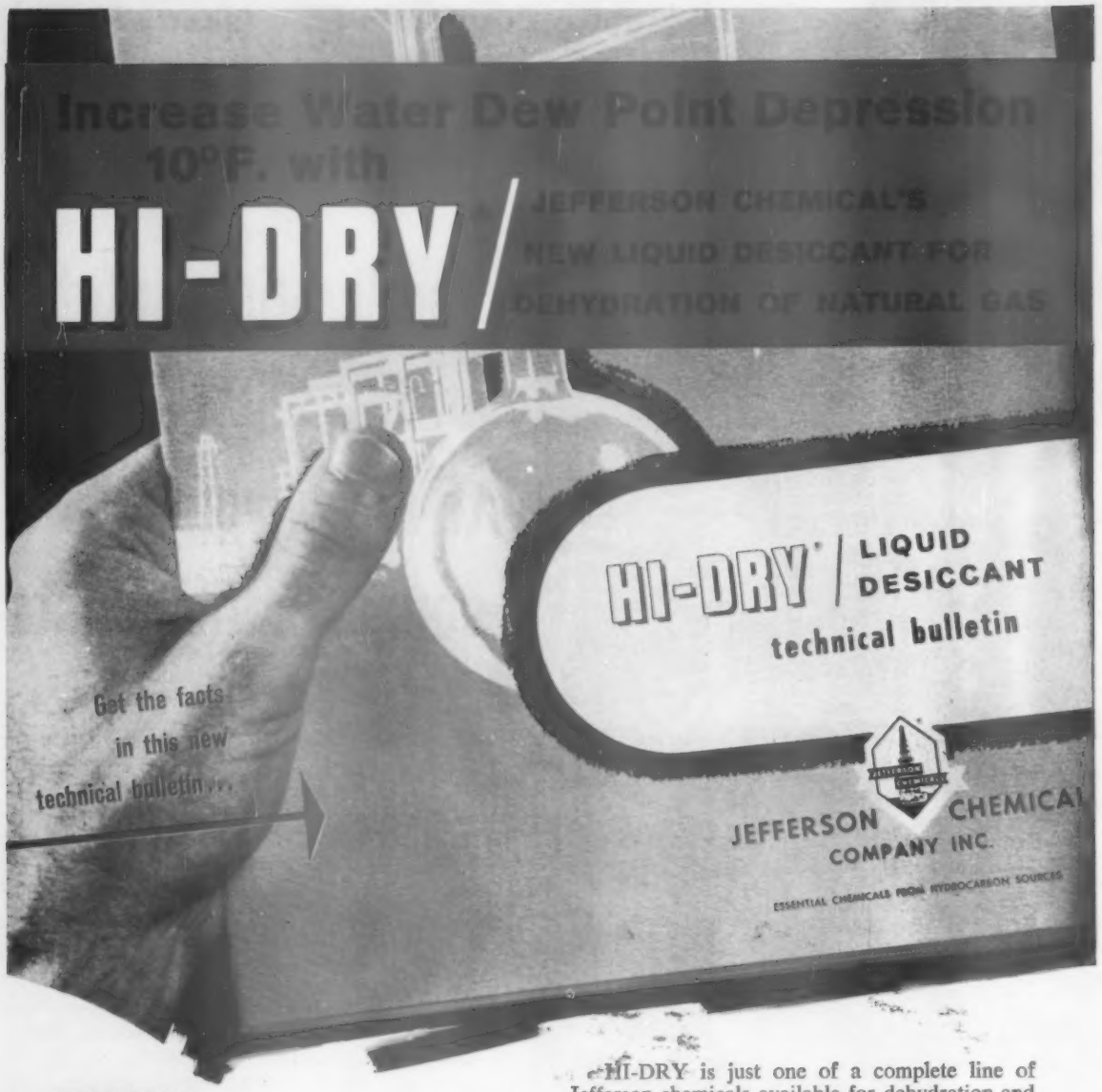

HI-DRY® brand liquid desiccant is a tetraethylene glycol concentrate developed specifically to give you the extra dew point depression so often needed in the dehydration of natural gas. Extensive field tests indicate that reconcentration of HI-DRY at 435°F. and triethylene glycol at 375°F. are comparable in level of thermal stability. The lower vapor pressure of HI-DRY, in addition to the increased degree of reconcentration achievable due to its greater thermal stability, offers an advantage in the dehydration of higher temperature gas streams such as those experienced at compressor stations.

Provided in this new HI-DRY technical bulletin are sales specifications, shipping information, typical applications and physical properties. From the physical properties you may readily estimate the results obtainable with various operating conditions.

HI-DRY is just one of a complete line of Jefferson chemicals available for dehydration and sweetening. Jefferson's extensive background of experience in gas treating processes is at your disposal. For helpful technical services, samples of HI-DRY liquid desiccant, or the new HI-DRY technical bulletin . . . contact Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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Ethylene and Propylene Oxides, Glycols, Dichlorides • Ethanolamines
Morpholine • Piperazine • Polyethylene Glycols • Nonyl Phenol
SURFONIC® Surface-Active Agents • Ethylene and Propylene Carbonates
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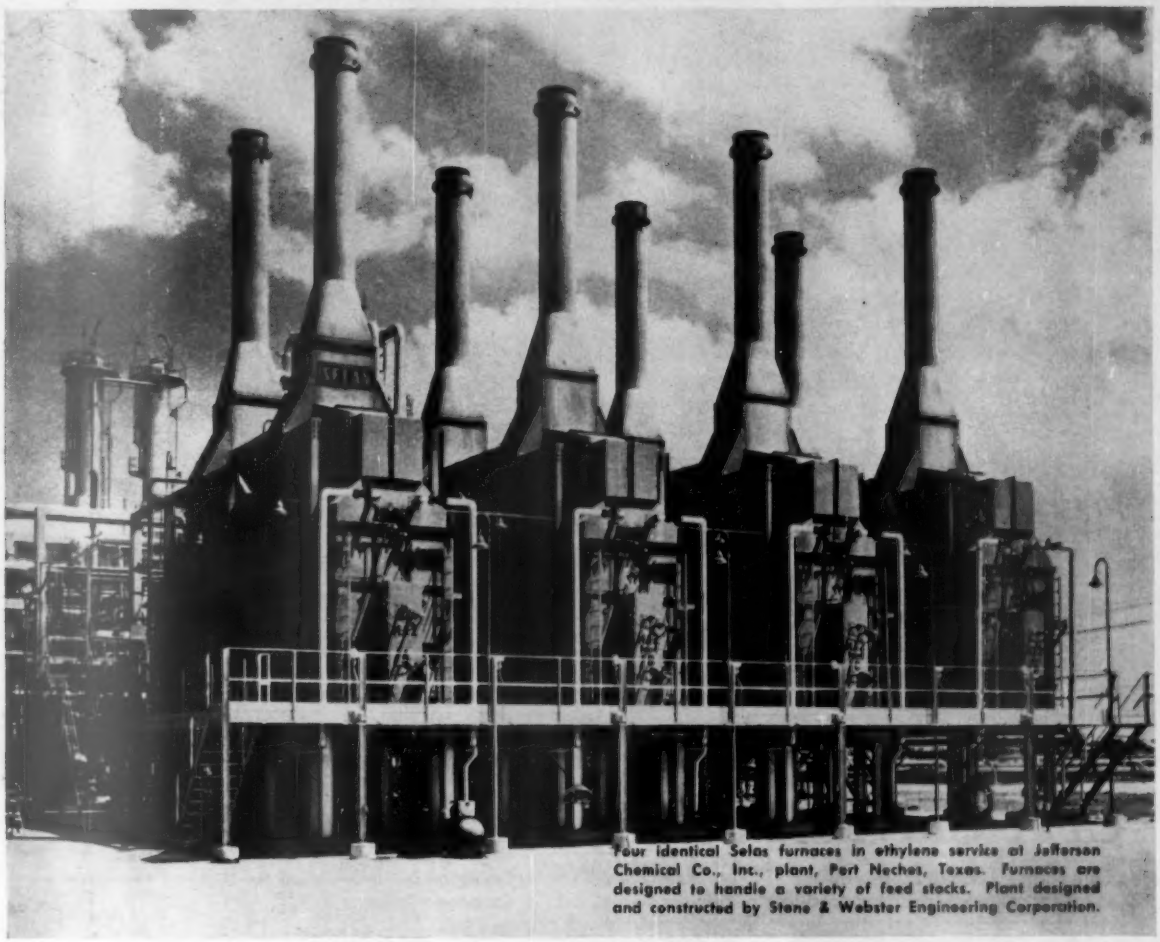
JEFFERSON CHEMICAL
relies on Selas Gradiation® Heating for
ZONE CONTROL • PRECISENESS • UNIFORMITY



Four identical Selas furnaces in ethylene service at Jefferson Chemical Co., Inc., plant, Port Neches, Texas. Furnaces are designed to handle a variety of feed stocks. Plant designed and constructed by Stone & Webster Engineering Corporation.

In ethylene production, the following inherent features of Gradiation heating have been translated, at Jefferson Chemical Co., into . . . *Longer on-stream periods . . . fixed amount of production with less feed stock . . . greater depth of cracking when limited by actual metal temperatures:*

- Zone Control . . . Duradiant® burners can be adjusted to desired heat pattern, in horizontal rows, to produce optimum reactions in pyrolysis.
- Uniformity of heating . . . even-heat distribution along and around tubes, increases tube life by eliminating hot spots, minimizing coke formation.
- Preciseness of heating . . . complete combustion within Duradiant burner cup permits placing burners close to tubes . . . achieving fast heat-up and instantaneous response to controller demand.
- Versatility . . . Gradiation heaters can handle a variety of feedstocks, interchangeably, under optimum conditions.

May we arrange for a Selas field engineer to discuss your heat processing needs with you? For this service . . . without cost or obligation to you . . . or for a copy of Bulletin 810 "Gradiation Heating for Petroleum and Chemical Processing," write to Mr. K. W. Fleischer, vice president, Fluid Processing Div., Selas Corporation of America, Dresher, Pa.

Gradiation and Duradiant are tradenames of Selas Corporation of America.

SELAS CORPORATION OF AMERICA DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers

DEVELOPMENT • DESIGN • CONSTRUCTION

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This giant steelman represents CF&I... in its capacity as an experienced, primary producer of quality steels and steel products, including large diameter welded steel pipe.

CF&I's Claymont plant melts its own steel, rolls its own plate, and produces top-quality large diameter welded steel pipe of all kinds—to API and various other specifications.

CF&I-Claymont Large Diameter Pipe is supplied for many standard and special uses, including:

- Natural Gas or Crude Oil Transmission Lines (High Pressure)
- Low Pressure Gas Lines (within urban limits)
- Casing or Encasement Pipe for Highway and Railway Crossings
- Compressor Station Piping
- River Crossings (Heavy Type)
- Gas and Oil Storage Lines

Standard sizes of CF&I-Claymont Pipe, from 22″ through 36″ O. D., in 40′ lengths, and special sizes to customer specifications, can be supplied.

Check Claymont first, when you need large diameter pipe of any kind, for any use. Contact the CF&I sales office nearest you for complete details.

CF&I-CLAYMONT PRODUCTS: Carbon Steel Plates • Alloy Steel Plates • CF&I Lectro-Clad Nickel Plated Steel Plates • Clay-Loy High Strength Low Alloy Steel Plates • Flanged and Dished Heads • Manhole Fittings and Covers • Fabricated Steel Plate Products • Large Diameter API Pipe

Claymont Steel Products

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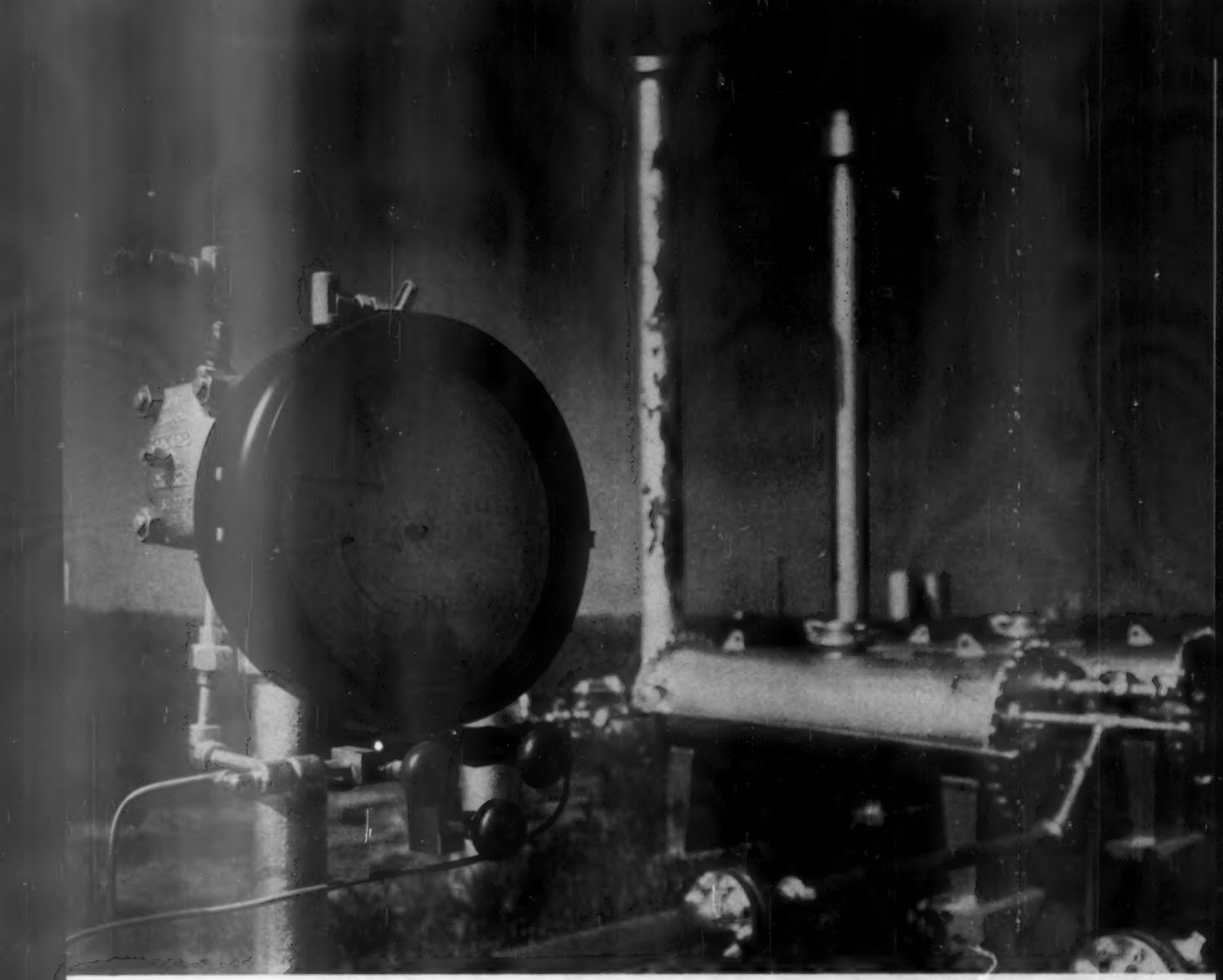


One of the 11 Foxboro T/37 Dry Flow Meters, measuring wet gas to separators, at W. L. Pickens' North LaWard Field, Jackson County, Texas.

"Wet gas can't foul it . . . overrange can't hurt it . . . and it doesn't need maintenance"

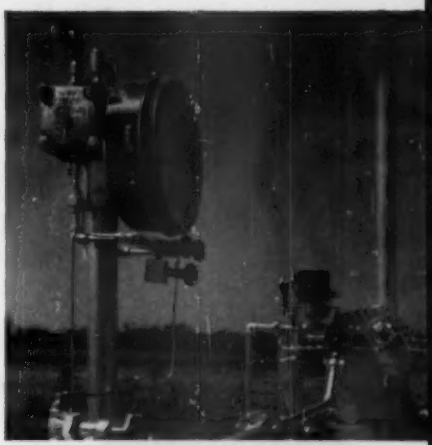
THE FOXBORO T/37 DRY FLOW METER

"Undoubtedly the most reliable flow meter we've ever used." That's the report on the 11 Foxboro Dry Flow Meters at W. L. Pickens' North LaWard Field in Jackson County, Texas.

Walter B. Hollow, Drilling and Production Superintendent, states that even though these meters have been in service over a year, none have ever needed re-calibration.

"The Foxboro Dry Meter also eliminates a problem we had of mercury being lost on sudden overranges caused by line surges," Mr. Hollow adds. "And of course, our weekly chore of draining mercury to remove water is a thing of the past."

Producers, pipeliners, plant men —they're all praising this outstanding Foxboro flow meter. Get the complete story on the T/37 in Bulletin 7-15. Or ask your nearby Foxboro Field Engineer. **The Foxboro Company, 6010 Norfolk St., Foxboro, Massachusetts.**



Specially-formed diaphragm discs and solid metal spacer rings insure the T/37 Dry Meter from overrange damage. Spacer rings also protect diaphragm assembly from rupture or distortion by dirt particles—or hydrates formed in moisture of gas lines.

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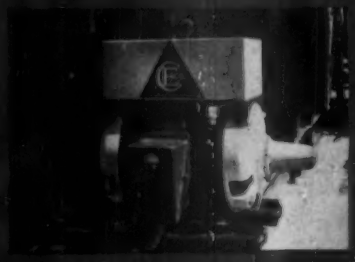

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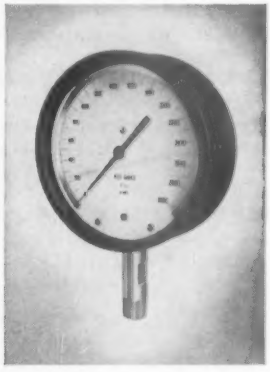

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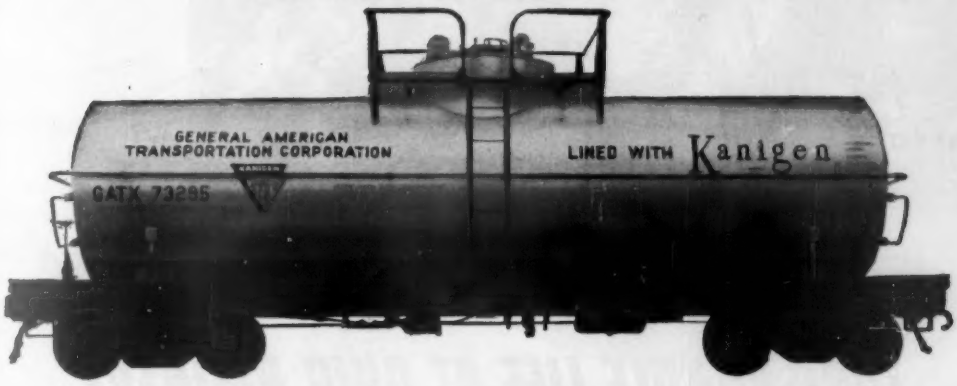

The interior of this General American tank car is chemically plated by the KANIGEN® process, which deposits a hard, uniform, corrosion-resistant, lifetime nickel alloy coating. You can load at high temperatures. For example, 73% caustic soda can be piped in at unlimited temperatures. GATX tank cars lined with KANIGEN are also being used successfully for liquids such as tetraethyl lead, glycerine, ethylene oxide, resins, fatty acids, glucose, and many others.

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report

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The detergent action of KONTOL Corrosion Inhibitor provided a *plus* benefit for the refinery. A cleaner operation has resulted in the gain of an additional 6,000,000 BTU's per hour—or a savings of about $96.00 per day.

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The KONTOL product used in this case was based on a careful study of the refinery's specific needs. The Tretolite Company developed and pioneered the application of organic corrosion inhibitors throughout the petroleum industry. No other organization has Tretolite's wealth of experience and know-how in the manufacture and use of these products. This background (Tretolite corrosion engineers, laboratory and research facilities) is always available to you—to help solve your particular corrosion problems. A call will bring you this service—at no obligation.

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They Say—

Scrambled equations

Dear Sir:

The article "New Correlation for Two Phase Pipeline Flow," by Dr. Jose A. Chavez in the August 24 issue of The Oil and Gas Journal (p. 100) has two inconsistencies which may be misprints.

Figure 1 on page 100 shows K to vary between 1.0 and 10. I think it should vary between 0.1 and 1.0.

Also, on Figure 2 (p. 100) the parameter R_M is shown to be a function of μGA while in the article proper on page 101 it is shown to be a function of P_{GA}. From the nomeclature table it would appear that μGA is correct.

B. L. Pritchard
Celanese Corp. of America

(Editor's note: Reader Pritchard is correct on both counts, and so was Author Chavez in his original manuscript. The errors were made in reducing the manuscript to the printed page.)

Heavy fuel may run short

"Members of the oil industry who are in the heavy fuel oil business anticipate a difficult time in supplying their customers this winter. Present forecasts indicate sizeable shortages under existing import allocations.

"Although coal is the competing fuel from a cost basis, few customers are in a position to convert to coal on short notice, nor do many of them want to. Only shortages and economic pressure would force them to do so.

"Therefore, with demand for heavy fuel oil increasing, domestic production decreasing for obviously economic reasons, and the selling price limited by a competing fuel, it is clear that imported heavy fuel oil is not competing with domestic crude in this market. The only reasonable solution to expected shortages is relief in the form of increased heavy fuel oil imports.

"The coal industry, of course, is opposed to this solution. Its spokesmen claim that heavy fuel oil imports have caused them serious damage. Admittedly, increasing fuel oil use has had some effect on the coal industry, but certainly it has been minor compared to the effect of other factors.

"In recent years the share of the

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U. S. energy market supplied by gas and oil has increased markedly. In 1948 the oil and gas industry provided 51% of our energy requirements. By last year this had grown to 72%.

"Particularly significant is the fact that, even though the total energy supplied by gas and oil has increased steadily, the growth of gas has been appreciably more rapid than that of oil. In 1948, gas provided less than 29% of the energy supplied by the oil and gas industry, while last year's gas share was over 36% of the total."

M. A. Wright, director, Standard Oil Co. (N. J.), in a speech to the Texas Mid-Continent Oil and Gas Association.

Automation still an infant

"Automation is more than the substitution of machine power for muscle power. It carries with it the profound notion that man may delegate to machines certain limited types of decisions, including the technique of continuous sampling by sensing devices.

"This promises to provide the flexibility to change any or all phases of a process as a result of machine analysis and control. Eventually, we will find that automatic electronic devices will link production and marketing. There are today a number of examples in which automatic electronic data-processing equipment ties plant production to the problems of marketing and management.

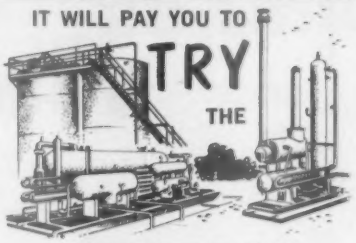
"We have gotten the impression that automatic devices in industry are coming into increasing use and, to the extent that this is true, this is good for technology. But automation, it must be remembered, is still in its infancy. There is still a great deal of instrumentation research, development, and application which has to be done. We still have a long way to go before we will have a completely integrated and automated industry."

Allen V. Astin, director, National Bureau of Standards, in a speech at dedication of Leeds & Northrup Co.'s new research center, North Wales, Pa.

Alaskan program explained

"I can say this, with total confidence. We of the West Coast petroleum industry need oil of good quality in reasonable proximity to our markets. The discovery of sizable commercial deposits of oil in Alaska would be welcomed as eagerly by the

IT WILL PAY YOU TO



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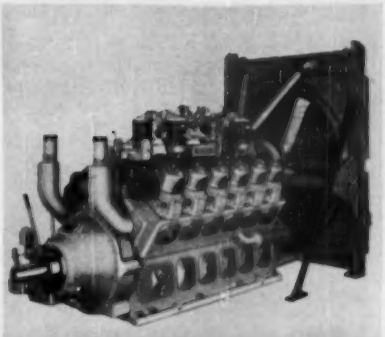

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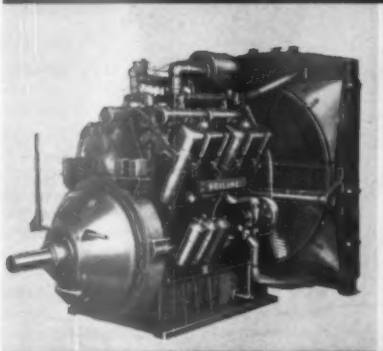

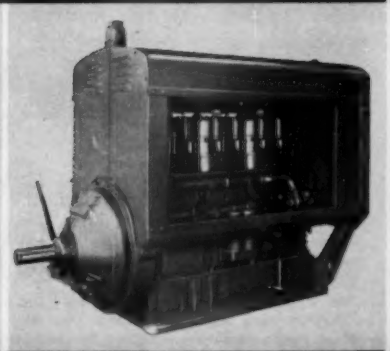

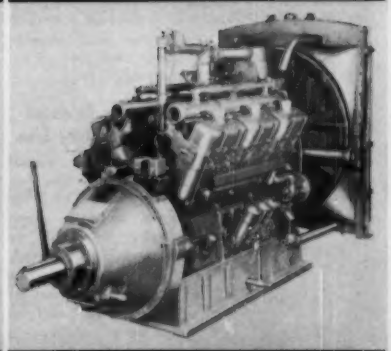

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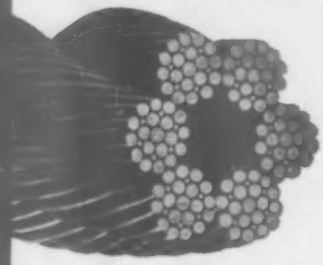
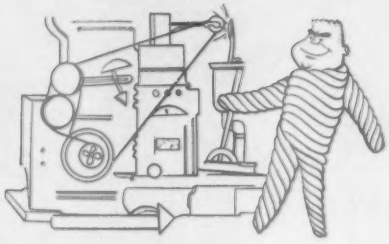
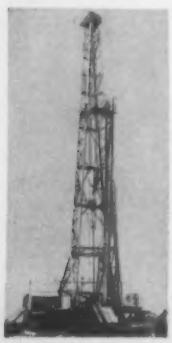




...and Every Part Must Fight Destructive Forces

A "look inside" a piece of wire rope reveals a precision-designed assembly of working parts. The parts are core, wire and strand. They are subjected not only to external and internal stresses and strains, but also to heavy surface pressures and abrasions. All these forces may be sustained while the rope is running under very high speeds, and abruptly changing direction of motion. That's why different uses require different constructions of wire rope.

Tuffy Balanced Standard Rotary Line helped drill the world's deepest well—Wildcat I-EE in Pecos County, Texas. This rotary line is famous for top performance in use with standard rigs in any formation. It also does an outstanding job with jacknife rigs in deep drilling beyond 6000 feet.



Tuffy Balanced Jacknife Rotary Line: Made to the special needs of jacknife rigs drilling to 6000 ft. Has extra strength, with greater flexibility to move at higher speeds over the smaller sheaves and drums of jacknife rigs, and to give better reeving and spooling.

Extra Strength Alone is Not Enough... Wire Rope Must Be BALANCED

Sometimes extra strength is heavily stressed in advertising wire rope. While strength is important wherever wire rope is used, it is not the only important property. And there are cases where too much strength is a liability.

For example, manufacturers of scrapers have designed their equipment to take certain loads. These loads are controlled by, or subject to the ultimate strength of the rope. Larger ropes with higher strength do not break, but *the equipment itself begins to break up.*

Depending on your use of wire rope, the "job prescribed" Tuffy Special Purpose Ropes give you the RIGHT BALANCE of strength, toughness, flexibility for greatest efficiency and longest service life.

Tuffy Balanced Slings & Hoist Lines This team has made a name for cutting hoisting and downtime costs in all types of materials handling. Tuffy Hoist Line gives the balanced combination of strength and flexibility needed for a longer running rope. Tuffy Slings are made of an extra flexible, high-strength machine-braided fabric that smooths out uninjured after knotting or kinking.

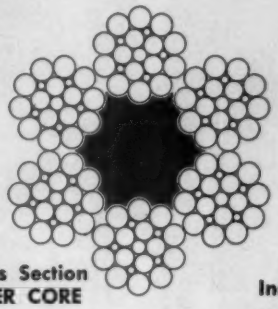
FREE!

Complete handbook of wire rope use in oil field service

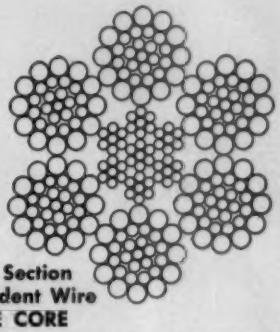
Latest, most complete information ever compiled on the subject in one publication. Shows the various rope constructions used by the oil industry, and gives full data tables on each. Includes (in their entirety) "A.P.I. Specifications for Wire Rope" and "A.P.I. Recommended Practice on Application, Care and Use of Wire Rope for Oil Field Service."

Write Union Wire Rope Corporation, 2102, Manchester Ave., Kansas City 26, Mo. Specialists in high-carbon wire, wire rope, braided wire fabric and stress relieved wire and strand.

Let's Take A Look at the CORE of Wire Rope



Cross Section
FIBER CORE

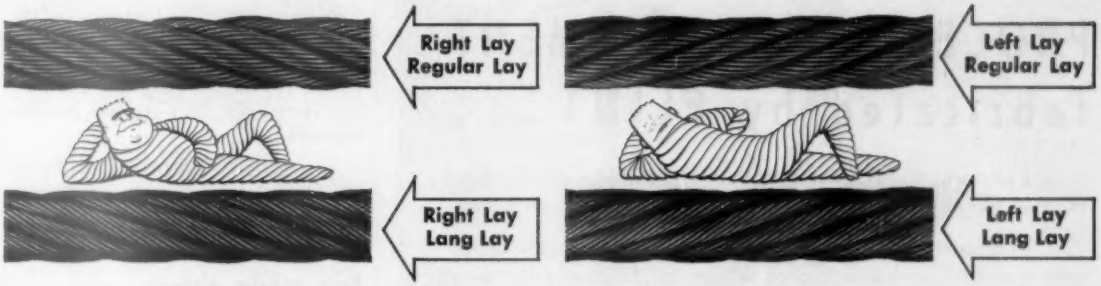


Cross Section
Independent Wire
ROPE CORE

It's either fiber or steel. Fiber cores are usually made from sisal, java, manila or combination of such hard fibers. Steel cores are either wire strand or an independent wire rope core, which amounts to a separate wire rope. The core serves as a base for the strands, keeping the rope in round shape and providing clearance between the strands for freedom of movement.

It's easy to see why wire rope is a "machine"—deserving the same care in selection and use that is given to any fine machine.

Which Lay of Wire Rope is Right for What Use



The "lay" of a rope is described in directional terms. It's a **right lay** when the strands pass from left to right across the rope. It's **left lay** when they pass from right to left.

Wire rope is also either **regular** or **lang lay**. In the **regular lay** the wires are laid in strands opposite in direction to the lay of the strands. In the **lang lay** rope, the wires are laid in the strands in the same direction as the lay of the strands.

Most wire rope is regular lay. It has the greatest stability under the widest range of uses. On the other hand, lang lay is used in applications where greater flexibility and longer wearing services are needed.

FREE!

Complete Splicing and Socketing Manual with engineer's notebook on wire rope constructions and specifications. Write for your copy now. Address Union Wire Rope Corporation, 2102, Manchester Ave., Kansas City 26, Missouri.

Specialists in high carbon wire, wire rope, braided wire fabric, stress-relieved wire and strand.

Good Man to Know: Your Nearby Union Wire Rope Distributor

Whether your wire rope need is a scheduled replacement or a red-hot emergency, your Union Wire Rope distributor is ready. He keeps varied stocks of Union standard constructions and the Tuffy Special Purpose Ropes. And he's backed by quick service from his nearby Union Wire Rope depot.

If it isn't rope you need, but advice on a wire rope problem, he's just as ready to help. If you don't know your Union Wire Rope distributor already, look under "Wire Ropes" or "Slings" in your telephone directory yellow pages.

Your Tuffy Distributor Can Help You Get Longest Service Life and Cut Rope Costs

UNION Wire Rope

New steels are born at Armco

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Southwest Steel Products

4

PROCESSING EQUIPMENT
fabricated by FLINT . . .

is used in many of the newer petroleum and chemical plants where exacting specifications to achieve maximum performance are a must.

Flint's plate fabricating facilities are among the largest in the country and seldom can be pushed to capacity. Highest quality control is exercised while tight delivery dates are met.

In the plant, eight and one half acres under roof, more than 61,000 sq. ft. of manufacturing area handles nothing but plate.

All pressure vessels are fabricated to ASME code, from Carbon, Alloy, and Alloy Clad Steels.

Flint X-ray equipment is used to check all weld seams before shipment.

ALSO: Fabricated Galvanized Steel
Fabricated Structural Steel
Fabricated Reinforcing Steel
and Steel Service Center

FLINT STEEL

P. O. BOX 1289 • LU 4-3621
TULSA 1, OKLAHOMA

STEEL PLATE FABRICATORS ASSOCIATION

STEEL IS AVAILABLE NOW

West's oil industry as by Alaskans themselves.

"Some Alaskans perhaps were disappointed that the discovery at Swanson River did not immediately set off a widespread drilling program by ourselves and by other oil companies. We were asked why we did not at once bring in three, or four, or even more drilling rigs to drill up this new field as rapidly as possible.

"We have had the practical answer to that question in the months since the discovery. Each well that has been drilled—whether productive or dry—has enhanced our chances of choosing a productive site for the next development well.

"This step-by-step approach is minimizing failures, and thus avoiding wasteful development costs. Contrariwise, if we tried to drill these wells four or five at a time, the ratio of dry holes to producers at this stage of development would almost certainly be higher.

"I don't believe I need belabor the point that neither the oil industry nor Alaska can afford an excessive number of dry holes. They are not only bad financially, they are bad psychologically."

T. S. Petersen, president of Standard Oil Co. of California, in address to Pacific Northwest Trade Association, Fairbanks, Alaska.

Fair trade pitfalls

"Most advocates of fair trade have been groups of dealers and retailers who see it as sure way of ending and preventing price wars, and of assuring stable prices and margins. To them it promises health, wealth, and prosperity for everyone.

"These promises are the great attraction for fair trade. But these promises rest on three assumptions. First you assume price rigidity is a good thing. Second, you assume you can insulate the marketing segment from the practices and conditions prevailing in the rest of the industry. Third you assume that all brands would be covered by fair trade.

"It has been known for many years that the antitrust division of the Department of Justice is opposed to fair trading. We certainly got first-hand evidence of their attitude when . . . the department secured an agreement to refrain from fair trading gasoline on the West Coast for 5 years.

"Any widespread extension of fair trade by the petroleum industry may well cause additional harassment and governmental investigations. One might wonder if any outstanding success of fair trading in creating price rigidity might lead some states into

the next logical step: An attempt to insure price stability by means of a state public utility commission of some nature."

J. G. Jordan, Shell Oil Co. vice president for marketing, in a speech to the Ohio Petroleum Marketers' Association.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

OCTOBER

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft engineering forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

9-10 Appalachian Geological Society, Pittsburgh Geological Society, field conference, Cacapon Lodge, W. Va.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

15-17 National Society of Professional Engineers, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

16-17 University of Texas, E. P. Schoch lectures series, process control, University of Texas, Austin.

19-21 American Society of Civil Engineers, pipeline division meeting, Statler Hotel, Washington.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton-McAlpin Hotel, New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.

26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

27 American Institute of Chemical Engineers, New York section, technical symposium, Hotel New Yorker, New York.

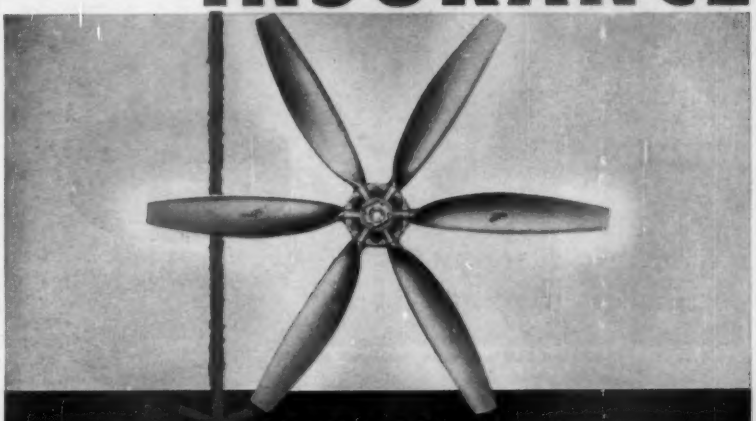
28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

28-30 Society of Automotive Engineers, fuels and lubricants meeting, La Salle Hotel, Chicago.

28-30 American Association of Petroleum

ENDURANCE INSURANCE



with HARTZELL All-Aluminum Adjustable Pitch Fans

Hartzell all-aluminum heat exchanger and cooling tower fans last and last and last under the most severe operating conditions. On hundreds of installations these fans operate continuously, moving great volumes of air to provide efficient, dependable performance.

• Hubs and blades are durable, high strength aluminum alloy that provides exceptional resistance to corrosion. • Blade shanks are threaded to fit threaded blade housings cast into hub. • Blades may be turned to change pitch by merely loosening two bolts. • **Because all hubs are dynamically balanced and all blades balanced against a master blade, damaged blades may be replaced in the field without destroying the balance of the assembly.** • Eleven sizes, 40" to 132" diameters; 3, 4 and 6 blade assemblies.

Ask your Hartzell Field Engineer for complete details or write direct for Bulletin A-111B.

Other famous Hartzell products include industrial fans and blowers, controllable and full feathering propellers for light aircraft, crop drying equipment, and farm ventilating fans.

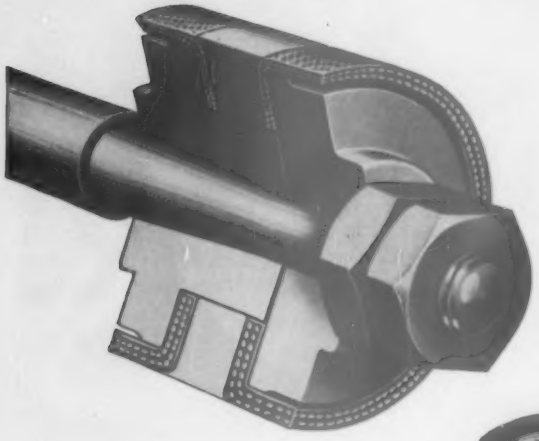
HARTZELL PROPELLER FAN CO.

Engineering Offices in Principal Cities

Div. of Castle Hills Corp.

Piqua, Ohio

LESS FLUID SLIPPAGE!
LESS DOWNTIME!
GREATER EFFICIENCY!



...in hydraulic and pneumatic mechanisms, reciprocating pumps

Darcova Pumcup

Darcova 45° Bevel Type Pumcup

THE BIG DIFFERENCE you'll find in Darcova Pumcups is that they operate at full efficiency *throughout their entire life.* This means fluid slippage is virtually eliminated.

And because fewer replacements are necessary, you have less downtime. Users report that Pumcups *outlast ordinary packings at least 3 to 1!*

Pumcups are available in three textures—hard, medium and soft. Also in regular or 100% nylon composition. Sizes range from ¾" to 20". For all the facts on Pumcups, write for Bulletin 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

TRADE MARK
PUMCUPS

Geologists, Mid-Continent regional meeting, Broadview Hotel, Wichita.

29-30 Oil Recovery Symposium on Southwest Texas, sponsored by southwest section of AIME and Texas Petroleum Research Committee, Driscoll Hotel, Corpus Christi, Tex.

NOVEMBER

1-2 Western Petroleum Refiners Association, second computer conference, Hotel Tulsa, Tulsa.

2-4 Geological Society of America, annual meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

4-6 Rocky Mountain Oil and Gas Association, fourteenth annual convention, Brown Palace Tower, Denver.

4-6 Institute of Radio Engineers, national automatic control conference, Sheraton Hotel, Dallas.

9-10 National Academy of Sciences-National Research Conference, first international symposium on fire research, National Academy of Sciences, Washington.

9-11 American Petroleum Institute, thirty-ninth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

9-12 Society of Exploration Geophysicists, twenty-ninth annual meeting, Biltmore Hotel, Los Angeles.

12-13 American Association of Petroleum Geologists, Society of Exploration Geophysicists, Society of Economic Paleontologists and Mineralogists, Pacific section, thirty-sixth annual joint meeting, Biltmore Hotel, Los Angeles.

16-20 Fifth International Automation Congress and Exposition, New York Trade Show building, New York.

17-18 Natural Gas Pipe Line Institute, new Seward County Courthouse, Liberal, Kans.

19 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

20 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

20 Appalachian Geological Society, technical meeting, Charleston, W. Va.

22-29 Third Venezuelan Geological Congress, sponsored by Venezuelan Society of Geologists and Venezuelan Ministry of Mines and Hydrocarbons, Caracas.

29-Dec. 4 American Society of Mechanical Engineers, annual meeting, Chalfonte Haddon Hall, Atlantic City, N. J.

DECEMBER

1-2 Western Petroleum Refiners Association, second computer conference, Hotel Tulsa, Tulsa.

3-5 Interstate Oil Compact Commission, annual meeting, Sheraton Hotel, Philadelphia.

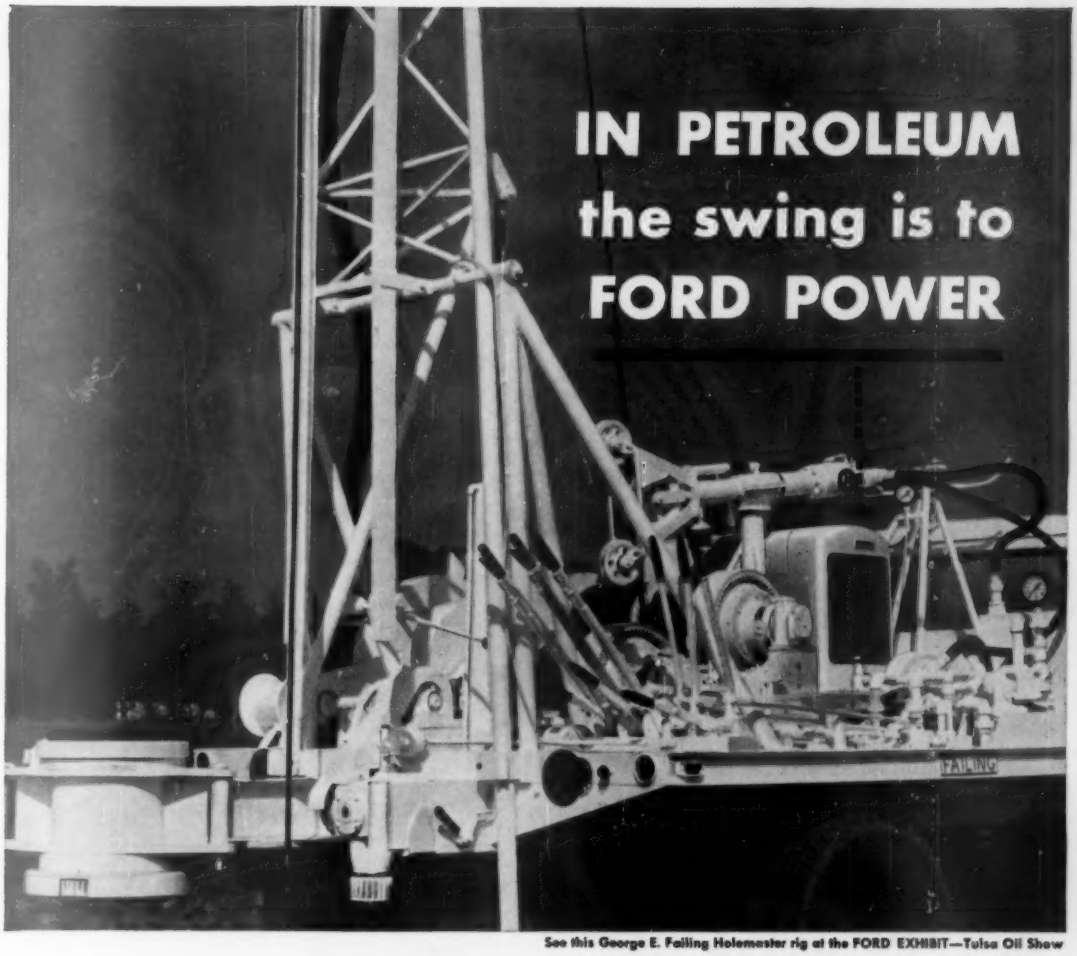
3-5 American Chemical Society, southwest regional meeting, Baton Rouge, La.

6-9 American Institute of Chemical Engineers, annual meeting, Sheraton Palace Hotel, San Francisco.

11-15 Society of Automotive Engineers, meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

JANUARY

22 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.



See this George E. Failing Holemaster rig at the FORD EXHIBIT—Tulsa Oil Show

... because Ford Engines are dependable and Ford Service is everywhere!

However tough your oil field job may be, a Ford Industrial Engine has the stamina and power reserve to handle it dependably and at low operating cost.

This is because Ford Engines have many advanced features such as Short Stroke Design for greater fuel economy . . . overhead-valve construction for added power and efficiency . . . and hard-faced valve seat inserts for longer engine life. ***All in all, these engines provide more horsepower per pound of engine weight than ever before possible!***

Ford Engines range from 134 to 534 cubic inches, including two ultra-modern Diesels and three Super Heavy Duty V-8's. All are available as engine assemblies or complete power units; gasoline engines can be adapted for LP-gas or natural gas.

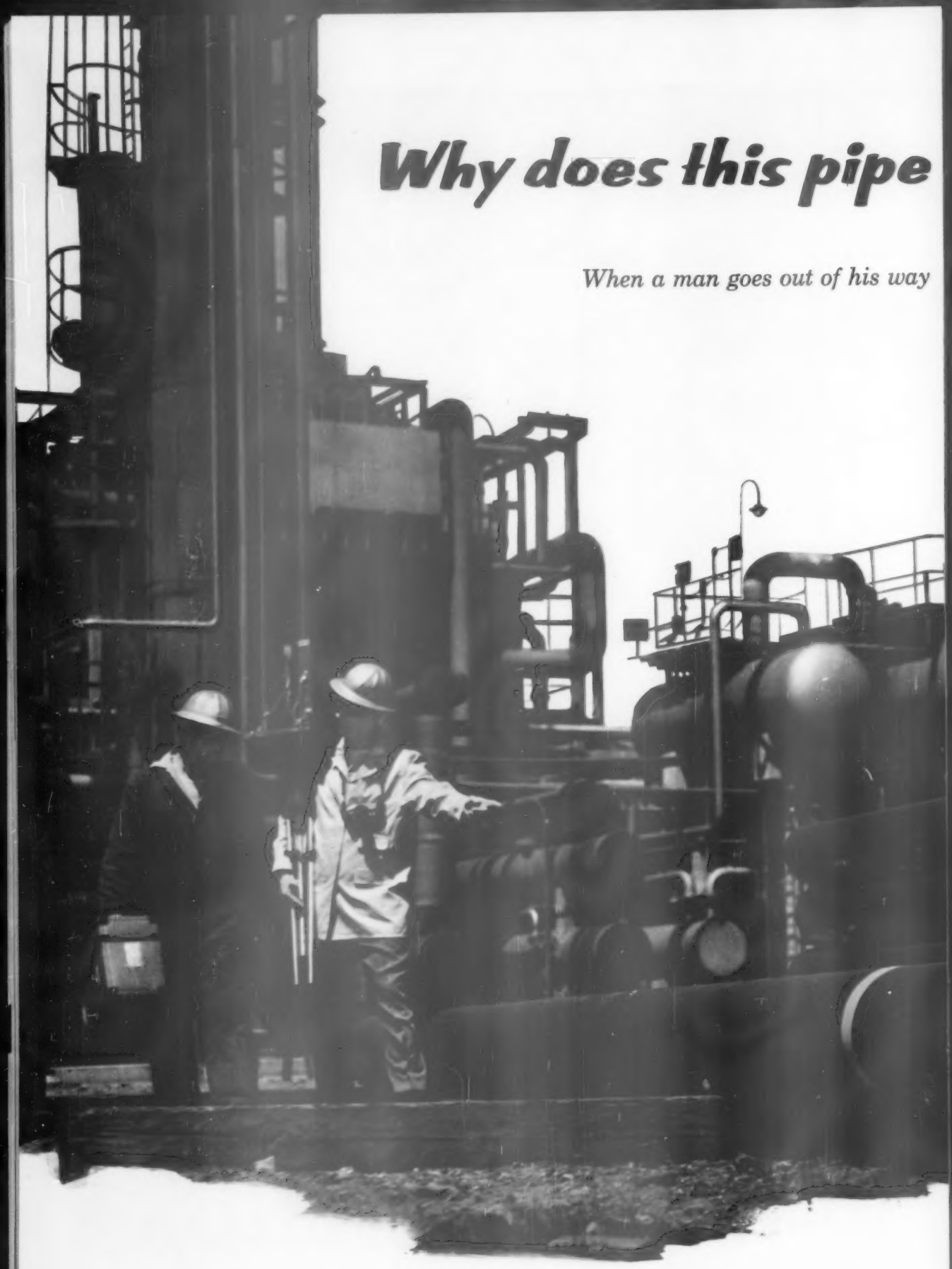
And because Ford Dealers are located everywhere, you can get low-cost Ford replacement parts *when you need them* to keep your equipment operating.

For these reasons, it will pay you to specify a Ford Industrial Engine the next time you're in the market for new equipment. You'll find there's a Ford Engine that's right for *your* oil field job. Write to the address below for further information.

Ford
INDUSTRIAL ENGINES
AND POWER UNITS

INDUSTRIAL ENGINE DEPARTMENT • FORD Division of FORD MOTOR COMPANY
P. O. Box 598, Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!



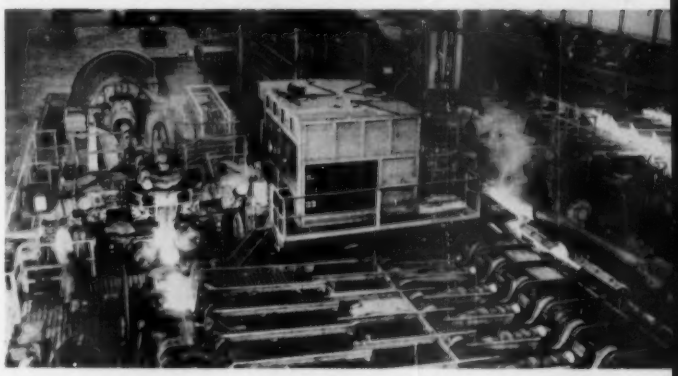
Why does this pipe

When a man goes out of his way

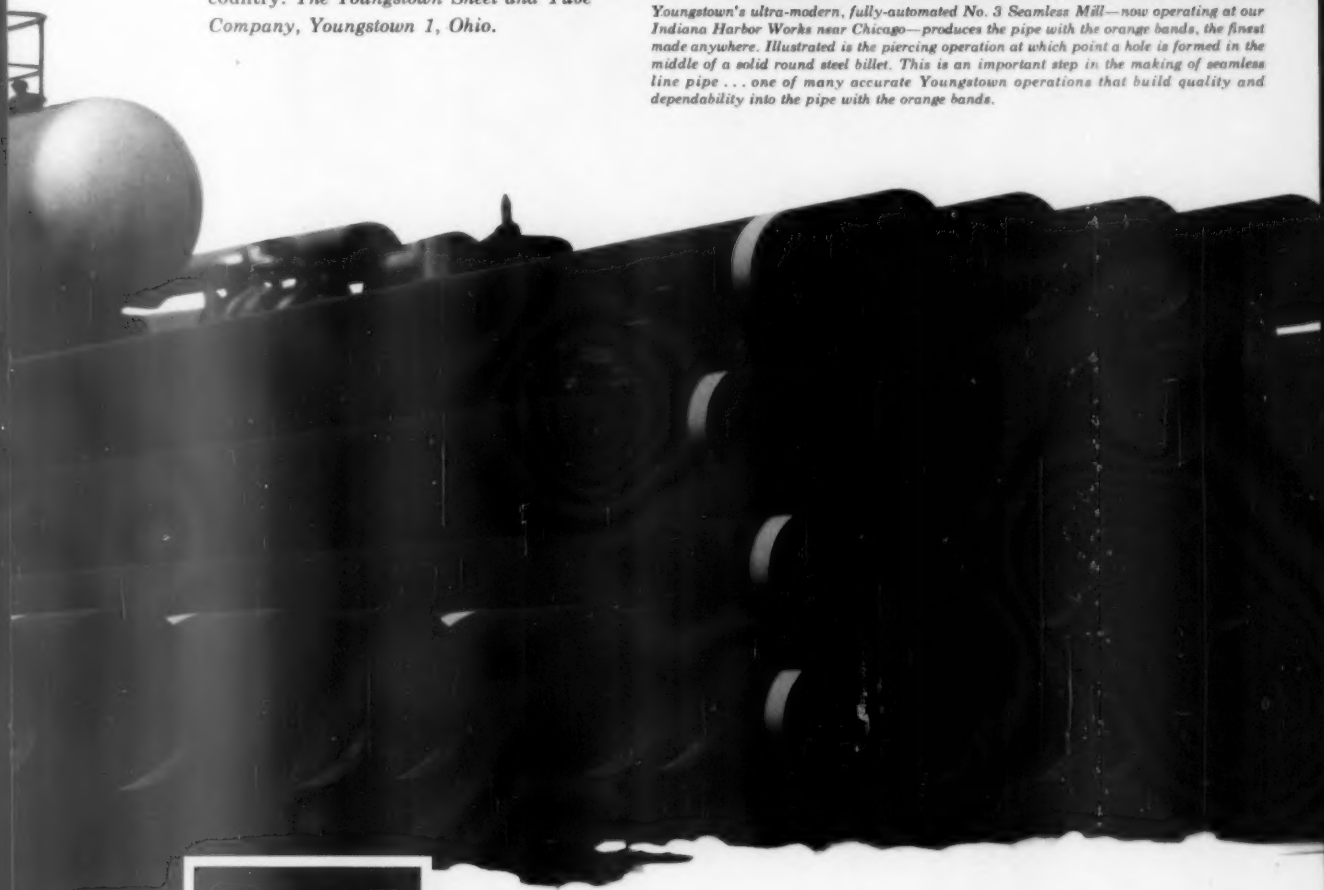
have an Orange Band?

to make a superior product...

he likes to brand it. This lets people know the quality they're getting. The orange band marks Youngstown seamless line pipe . . . the finest made. This high-strength, uniform quality seamless pipe is furnished with ends threaded, grooved, or plain end bevelled for welding and for various mechanical couplers. To obtain more information about Youngstown Line Pipe, contact our sales and service offices throughout the oil and gas-producing country. *The Youngstown Sheet and Tube Company, Youngstown 1, Ohio.*



Youngstown's ultra-modern, fully-automated No. 3 Seamless Mill—now operating at our Indiana Harbor Works near Chicago—produces the pipe with the orange bands, the finest made anywhere. Illustrated is the piercing operation at which point a hole is formed in the middle of a solid round steel billet. This is an important step in the making of seamless line pipe . . . one of many accurate Youngstown operations that build quality and dependability into the pipe with the orange bands.



QUALITY YOUNGSTOWN SERVICE

Youngstown

SEAMLESS LINE PIPE

"... pacing the pipeline construction industry
for more than a quarter century"

price tower H·C·PRICE·CO PIPELINE CONSTRUCTORS bartlesville, oklahoma

50 years ago

October 6, 1909

Newly formed Gulf Pipe Line Co. of Oklahoma takes over, under lease, all Oklahoma property and business of Gulf Pipe Line Co. of Texas. Incorporation in Oklahoma gives Gulf the right to exercise privilege of eminent domain in extending lines.

Pleas of oil men lead Missouri Pacific to inaugurate daily passenger-train service between Independence, Kans., and Oklahoma oil fields. Service to benefit many living in Independence and Coffeyville who have large interests in the booming shallow oil development around Nowata, Okla.

Silver Tip well in Coalinga field creates sensation in California with flow of more than 20,000 bbl. of oil daily. W. R. Guiberson is president of Silver Tip Oil Co., owner of the well.

25 years ago

October 4, 1934

West Columbia, one of Texas Gulf Coast's original prolific shallow salt-dome fields, stages comeback as new active drilling play gets under way in development of deeper flank sands.

U. S. oil industry completes full year with average crude price unchanged at $1 per barrel. Production during that period totaled 903,000,000 bbl.

Southwest Texas' most active field-development program gets under way at Sam Fordyce, where Hidalgo County's first producing well was completed last week. Twenty-four additional wells started.

10 years ago

October 6, 1949

New Pegasus deep Ellenburger field near Upton-Midland county line takes spotlight in West Texas as long stepout wells in several directions from discovery well give indications of production.

Specially converted LST loaded by Kerr-McGee Oil Industries, Inc., and Brown Drilling Co., joint contractors, with complete drilling equipment, materials, and supplies, leaves for Middle East Neutral Zone to serve as floating field camp for American Independent Oil Company's exploratory drilling operations.

Full-scale, fever-pitch town-lot drilling play, reminiscent of early oil-boom days, initiated in new Newhall-Placerita shallow-sand field only 20 miles from downtown Los Angeles. Close drilling may bring California townlot drilling law into contest.

JOURNALLY SPEAKING

What's in a Name Change

At 11:59 p.m. last Wednesday, Magnolia Petroleum Co. was still good ol' Magnolia. Sixty seconds later, it was a part of Mobil Oil Co.

Pretty fast work? Sounds easy. But, lest we incur the wrath of a few hundred frazzled Magnolia . . . wups, Mobil . . . clerks, we would like to point out that a name change isn't just a name change—it's a headache.

For more than 2 months prior to the change, a five-man group, impressively titled Name Change Task Group, studied and coordinated the necessary actions to change the Magnolia name on everything from letterheads, to leases, to pay checks, to service station signs.

More than 250,000 letters and notices pointing out the name change were sent to royalty owners, suppliers, credit-card customers, government agencies, editors, and other oil companies.

Roughly 15,000,000 individual pieces of stationery became outdated and unusable overnight. Some will be reprinted. But the company will save a fair hunk of change on much of it by simply rubber-stamping the new name over the old. For this little job, the company figures it will need more than 2,000 different rubber stamps.

The titles of ownership on each of 2,000 cars and trucks owned by Magnolia must be transferred in all states by October 10.

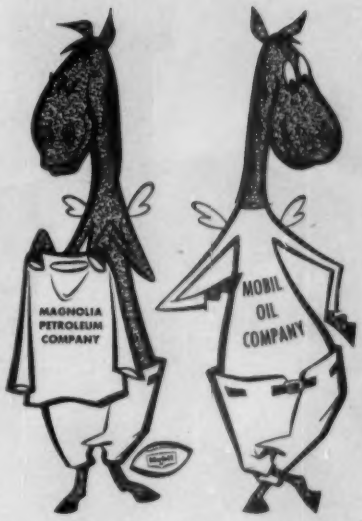
About 700 bank accounts had to be shifted from Magnolia to Mobil. To do this legally, signed and certified copies of a Magnolia board of directors resolution on the change had to be sent to each bank.

And then there are the service stations. Magnolia signs at about 5,000 service stations and bulk plants throughout Texas, Oklahoma, Louisiana, New Mexico, and Arkansas must come down. The "Mobil" emblem will remain.

Redressing the service stations is just the beginning in the name-change sign problem.

There are more than 25,000 Magnolia signs on leases, oil and gas wells, and other real estate. Each must be replaced with a Mobil counterpart.

So must the names be changed on thousands of other items like drilling permits, tax reports, manufacturing permits, credit cards, and insurance policies.



MAGNOLIA'S flying horse made the change like this in a brochure issued to news men. In it Magnolia asked reporters to "please use our new name . . . Mobil Oil Co., not 'MOBILE,' beginning October 1."

The final legal move combining Magnolia with Mobil was the filing of a certificate to that effect with the state government in each of the 18 states where Magnolia operated.

A key member of the Name Change Task Group which has seen to the carrying out of all this frenzied activity is John Booth, secretary. He tells us that, actually, all the name changing won't be completed for some time yet.

Legally, some of the changes had to go into effect by October 1. But it may take 6 months to a year, he says, before all of them are completed.

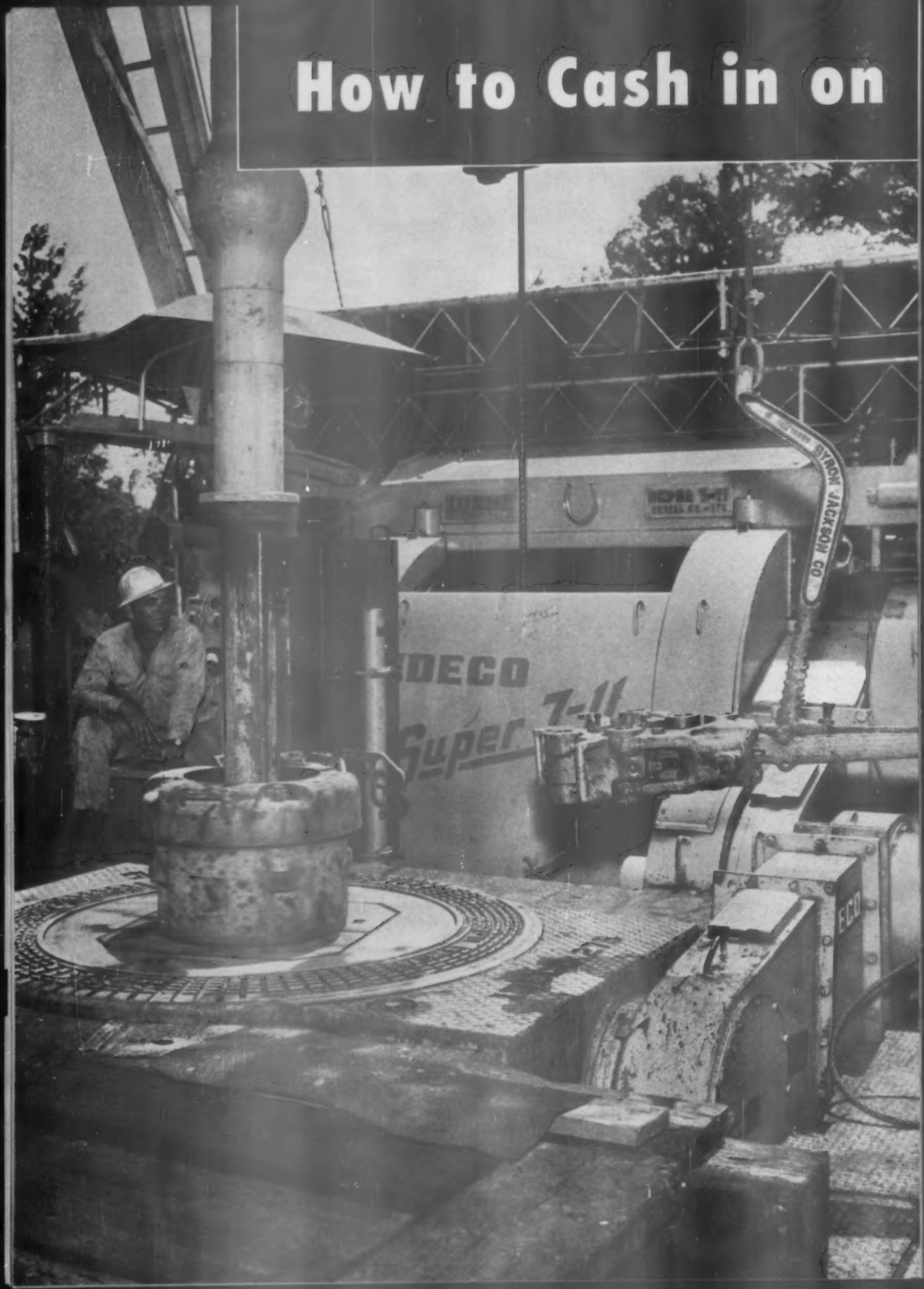
We have two little predictions to make concerning all this.

One is that it'll be far more than a year before the good old name of Magnolia is forgotten in the Southwest.

The other? That, thorough and exhaustive as were the labors of Name Change Task Group, we'll bet it forgot something!

—Bob Enright

How to Cash in on



J&L-Ideco Efficiency

Ideco Drilling Equipment includes drawworks and masts for every depth and application. Kwik-Lift masts are truck or trailer mounted. Full-View masts handle the world's toughest drilling offshore and on land. Ideco rigs incorporate every important improvement and convenience yet conceived for such equipment.

Spud in with complete *Ideco Drilling Equipment* backed by J&L Supply service and you're set to punch a hole for profit.

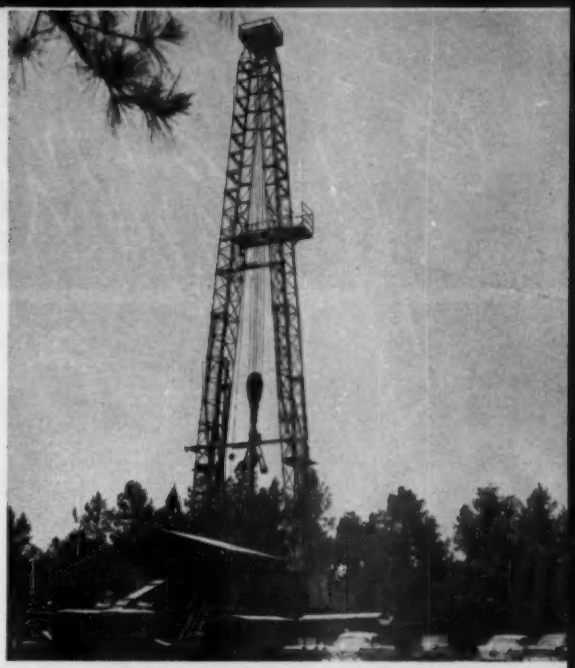
Another way to cash in on J&L-Ideco efficiency is to upgrade your older equipment with Ideco job-rated components. More Ideco rotaries are in use today than any other kind. Ideco crown blocks, traveling blocks, hooks, swivels and masts are ideal replacement items for drilling, workover and servicing equipment of any type and capacity.

Every J&L Supply man in the United States and Canada is ready with Ideco literature and helpful information. Call or write TODAY!

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available 73



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An oil tower of Babel won't help in Washington

Babel. 1. A city and tower in the land of Shinar, the scene of the confusion of languages (Gen. 11:9). 2. A structure impossibly lofty; a visionary scheme. 3. A confusion of cries, voices, or languages. —*Merriam-Webster*

THERE IS SOME DANGER that the oil industry may wind up with too many voices in Washington, particularly so if these voices have little harmony or leadership.

More and more oil companies and associations are opening offices in Washington, or increasing the size and the scope of their activities there.

Announcements of such moves by the Mid-Continent Oil & Gas Association, Continental Oil Co. and Gulf Oil Corp. are examples of this trend.

In many respects, this is a desirable development. There can be no doubt that on many occasions in the past, the oil industry has been speechless in Washington while oil foes hammered away at it in glee. At other times, oil spoke up, but often it was too late to have much effect.

However, the situation will not be helped if the influx of oil representatives into Washington results in a confusion of cries, voices, or languages.

WHAT IS SORELY NEEDED is a single "voice" in Washington to speak for oil on broad issues and to provide basic facts and figures for Congress, the regulatory bodies, and the working press.

This would not prevent company or association representatives from dealing with problems which affect them directly, but it would help oil present a solid front on many broad, basic issues.

One important contribution that company and organization representatives could make would be to help supply information to the "voice." This would help establish a single, reliable source for anyone needing information on the industry.

Obviously, such a single "voice" would not please all segments of the industry all the time. But in the long run it could prove highly beneficial to the industry as a whole.

BEAR IN MIND that what is needed most in Washington is factual oil information, not propaganda.

The industry should be perfectly willing to rest its case on the facts regarding depletion, conservation, import controls, etc.

Therefore, a single fact center in Washington would undoubtedly be an advantage. It is something the industry has talked about for a long time. Now would appear to be an opportune time to translate that talk into action.

Two Types of Wire Rope on Cleanout Job. Here's a recent cleanout assignment by Standard Drilling Co. in Pan American's J. M. Young No. 1, a 6350-footer near Oklahoma City. At the time of the photograph, two types of Bethlehem wire rope, ⅞-in. 6 x 17 Seale, and 9/16-in. 6 x 7 sand line, each with fiber core, were rounding out several weeks of operation. And doing a good job, too.

That's the story throughout the oil country. Wherever you look, you'll find Bethlehem wire rope hard at work. It's good sound rope, always dependable, always doing its part in paring down operating costs.

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Mill depots and distributors from coast to coast stock Bethlehem Wire Rope.

BETHLEHEM STEEL

Future Climate for Mergers: Colder

• A sharper eye on merger proposals is the plan of the Government's antitrust division. This doesn't mean an all-out war, but it does mean that Government hopes to shape industry into the pattern it thinks best.

Clyde La Motte
Washington Editor

THERE IS NO doubt that the Government is getting tougher on mergers, and it is quite likely that more and more attention will be given to mergers in the oil industry.

Government antitrust officials say flatly they intend to guard against any possibility that concentration within this industry might approach the stage it has reached in others, notably steel.

Thus it can be taken for granted that any oil merger involving firms of substantial size will be closely scrutinized either by the Justice Department or the Federal Trade Commission.

Robert A. Bicks, the acting assistant attorney general who heads the Justice Department's antitrust division, says "several" oil mergers are under study now and that close attention will be paid to others as they develop.

Bicks is quick to point out that this does not mean that the Government will crack down on all mergers. He cites Justice Department approval of the acquisition of Eastern States Petroleum Corp. by Signal Oil & Gas Co. as an example of a merger which he thinks promotes, rather than hinders, competition.

But he does make it clear that the Government has stepped up its pace against mergers and will continue to do so.

There are two basic factors underlying this increasing attention to mergers:

. . . The increase in mergers. This apparently has been prompted to a considerable extent by the need for increased size in many operations.

Even so, this tendency to bigness has caused concern in government circles.

. . . More government authority. The second major impetus to government action was legislation passed in 1950 which gave the antitruster a bigger club to use against mergers.

ROBERT A. BICKS
. . . Size is a big factor.

Until 1950, antimerger action was limited almost entirely to the stock acquisition of one company by a direct competitor.

But the change in law specifically included the acquisition of physical assets as well as the purchase of stock. And it provided for antimerger action in any type of acquisition that might result—directly or indirectly—in the lessening of competition.

What it means . . . This broadening of antimerger action means that a company may become subject to government suit on just about any type of merger.

It could be a "horizontal" merger, in which a company expands by buying another firm doing the same type of work, such as one refiner buying another.

It could be a "vertical" merger, in which a company buys its chief supplier of raw material or acquires a big consumer of its products to insure an outlet.

Or, it could be a "conglomerate" merger in which a company buys another in an unrelated or only slightly related field.

Antimerger yardsticks . . . A merger may be challenged by the Government on many points.

It may be attacked on the grounds that it hurts competition or tends to a monopoly in a given market area.

Thus, a merger might be challenged when two oil companies compete in only one market area even though each has numerous other market areas in which it is not in competition with the other.

Or a merger may be attacked on the grounds that it restricts competition in the sale of a specific product, although either or both of the companies involved may market many other products.

For instance, the Federal Trade Commission is trying to break up the merger of Gulf Oil Corp. and Warren Petroleum Corp. on the grounds that the merger seriously restricts competition in the sale of liquefied petroleum gas and natural gasoline.

The most important yardstick of all is the size of the merger involved. Bicks, currently the key figure in antimerger activities, explains that "bigness" as such is not the principal factor, but that the relative size of the merger in the industry concerned is of importance.

The merger of the two $5-million firms in the ping-pong ball industry might be challenged, whereas the merger of two $5-million oil firms could pass without notice.

Just what does constitute "bigness" in the oil industry? The antitrusters have not yet reached the point of drawing clear-cut lines.

You may be sure, however, that the merger of any two sizable oil companies, or the acquisition of even a relatively small firm by one of the large majors will draw the attention of the government antitrusters.

Government procedure . . . Both the Justice Department and the FTC have

The man to convince on mergers

ROBERT A. BICKS is a young man who looms large on the antitrust horizon.

He is now the acting assistant attorney general in charge of the Department of Justice's antitrust division. As such, he will have a large voice in determining the extent of the Government's activities in a broad range of antitrust activities.

He is a tightly wound energy machine, intense and active. He grasps information quickly, shuffles it through his mind rapidly, and makes decisions promptly.

Although he has been in his present position only a short time, he has taken a keen interest in the oil industry and can speak knowledgeably about the major oil antitrust cases.

Bicks has been climbing rapidly—he is only 32 years old—and it's a good bet that he has his sights set high.

He was graduated from Yale as a Phi Beta Kappa, studied economics at St. Andrews University in Scotland, and returned to Yale to graduate from the Yale school of law.

In 1953 he was appointed by Herbert Brownell, then attorney general, to be executive secretary of the attorney general's national committee appointed to study the antitrust laws and to propose changes.

The next step for Bicks was as legal assistant to the assistant attorney general in charge of the antitrust division.

In 1956 he was appointed acting first assistant of the antitrust division and on April 21 of this year was promoted to his present position.

established systems for learning about mergers that have been made or are in the planning stages.

There are three principal ways in which they hear of mergers: From newspapers or from financial and trade journals, from the companies themselves (as in the case of Texaco and Superior), or from a competitor who hears of a pending merger which he feels will hurt his business.

Once such information reaches either agency, a decision is made whether a further check is necessary. If so, letters are sent to the companies requesting such information as the type of operations involved, the comparative size of each company in its industry or marketing area, the extent of competition between them, and the nature of supply and market outlets each has.

This information is routed to the agency's economists and to any of its personnel who may be acquainted with the industry involved. The purpose is to determine what the effect of the merger would be.

When the investigation is completed, a decision is made on whether the proposed merger is desirable or undesirable. If undesirable, the companies generally are warned—if the merger has not taken place—that a suit will be filed if there is a merger.

Finally, the agencies may seek an injunction to block a pending merger or file a suit to force divestiture if the merger has already taken place.

A company's dilemma . . . There can be no doubt that the possibility of antimerger action must be considered seriously by any company considering a merger.

The usual first step in this consideration is to discuss the situation with attorneys who specialize in such work. But even these experts cannot be certain whether a particular merger will be challenged.

In cases of doubt, many attorneys give this sort of advice: If the merger is highly important, go ahead with it, even though it means running the risk of possible government action.

This is something of a roulette-wheel approach, since it is simply gambling on the chance that the Government will not investigate. At that, the odds aren't bad, for while there are hundreds of mergers a year, there are only a few antimerger suits.

If you do plan to go ahead with the merger whether the Government advises against it or not, there is no point in going to the government agencies in advance. If you do go and if there is any question in the Government's mind, you will simply be warned against the merger. In other words, if you ask in advance, you'll probably be told "no."

But the experts also advise this: If the merger isn't essential, you will probably be better off in the long run to check with the Government first or forget it, because it could lead you into long, and expensive, litigation. Bear in mind, too, that the Government has been winning most of the suits it has filed.

The antimerger impact . . . It is hard to overemphasize the long-range impact a stepped-up government drive against mergers will have.

Growth by acquisition may become extremely difficult, particularly by large or even medium-size firms. This means that companies must seek other ways in which to expand.

Those who may suffer most from the antimerger drive are the very firms the Government is seeking to protect—the small companies.

Many mergers, perhaps most of them, arise when a small company facing competitive difficulties goes to a larger firm with an offer to sell.

It is becoming more and more the practice for the larger firm to tell the would-be seller to get antitrust clearance and then come back for further negotiations.

Thus the small firms, or others in difficulty, may find the merger route gradually being closed.

In some instances, two small companies may merge to put each in a better position to complete with larger firms. But even in these situations, the merging firms must bear in mind the many angles the Government considers in merger situations.

The net result appears to be that more and more the Government will be in a position to shape industry and business into the pattern it feels is best. If so, companies will simply be losing more of their management prerogatives.

But that seems to be the way the merger picture is shaping up.

Why Justice Opposed Texaco-Superior Merger

THERE WERE three big reasons why the Department of Justice turned thumbs down on the proposed merger between Texaco, Inc., and Superior Oil Co. The reasons were:

. . . **The size** of the merger. The $765-million deal would have been the largest in oil industry history, uniting the biggest integrated domestic producers with one of the biggest independent producers.

. . . **The shape** of the merger. Texaco and Superior have many common crude purchasers, so a merger would mean that such customers would no longer have both Texaco and Superior competing for sales to them. This, Justice reasoned, would reduce competition.

. . . **The scope** of the merger. Some refiners who buy crude oil from Superior compete with Texaco in the sale of refined products. Thus a merger of the two would make Texaco a crude supplier for these competitors.

Too big . . . Although the department's antitrust officials insist that size alone is not the determining factor in antimerger action, there is little doubt that they felt the Texaco-Superior merger was "too big to let it get away."

For instance, one official commented that in natural-gas sales alone, the volume involved in the planned merger was as large as that of a thousand small gas producers.

It was obvious, too, that the department felt that by stopping the Texaco-Superior merger it would discourage other oil mergers. Had it let the merger stand, it would have been in an awkward position to oppose others, particularly those involving smaller firms.

Reasoning "absurd" . . . Texaco and Superior disagreed with the Justice Department's line of reasoning.

But in the end they decided to abandon the merger plan rather than face long, involved litigation which could keep the outcome in doubt for years and hamper the operations of each firm (OGJ, Sept. 28, p. 51).

Harold Morton, Superior general counsel, last week scored the Justice Department's opposition to the merger as "absolutely absurd."

He said the Government's sole objection to the consolidation was on the ground of "bigness." He contended this is not justified.

Morton said Superior accounts for about 0.5% of U. S. production today and Texaco has about 7%. The Superior lawyer said the difference between 7% nd 7½% won't support the government position.

Good politics? . . . Justice Department officials said the companies were cooperative throughout the investigation and the discussions it had with company representatives were "amicable."

Texaco had notified the department of the planned merger immediately after the two companies had reached an "agreement in principle" on a merger June 18.

Texaco began at once to supply the Government with information on the merger and on the operations of the companies involved. A series of conferences followed, ending with Justice's decision that it would sue if the merger were consumated.

There is little doubt that the Justice Department was pleased with the outcome.

And it is not at all unlikely that the case will be cited in next year's political campaign as evidence of the Republican determination to prevent "big business" from gaining too much power.

New Mobil Oil Co. Sets Up Operating Divisions

THE BASIC structure of the giant new Mobil Oil Co., which will handle all domestic operations of Socony Mobil Oil Co., Inc., was unveiled last week.

Mobil will direct exploration and producing operations from general offices in New York. It will have only four division offices.

These will be in Houston, Denver, Los Angeles, and Midland. The new divisions will be set up early next year.

Vice presidents have been named to head three of the four offices:

. . . **Henry L. Waszkowski, Jr.,** previously manager of Socony Mobil's producing department, will direct operations at Houston.

. . . **R. D. Hanley,** former vice president of Magnolia in charge of natural gas, supply-distribution, and petroleum chemicals, will head the Midland division.

. . . **E. V. Watts,** manager of exploration in Socony Mobil's producing department, will head the Denver division.

The Los Angeles division manager, Mobil said, will be chosen soon.

Henry L. Waszowski, Jr.

R. D. Hanley

E. V. Watts

Mobil dissolved Magnolia Petroleum Co. last week and absorbed its operations (see p. 91). The Mobil Producing Co. and General Petroleum Co. names will disappear about January 1.

Waszowski's Houston division will take in the Texas Gulf Coast, East Texas, Arkansas, Louisiana, Tennessee, North and South Carolina, Mississippi, Alabama, Georgia, and Florida.

The Midland division will take in all the rest of Texas plus all of New Mexico except the San Juan basin.

Denver will be responsible for eastern Colorado, Oklahoma, Kansas, Montana, Wyoming, and all other Midwestern and eastern states north of the Houston division area.

Los Angeles will direct operations on the West Coast, Idaho, Nevada, Arizona, Utah, Alaska, western Colorado, and the San Juan basin area of New Mexico.

The four Mobil divisions together will operate roughly 16,500 wells now producing about 240,000 bbl. of oil, 976,000,000 cu. ft. of gas, and 27,000 bbl. of natural-gas liquids a day.

Aneth Spacing: 40 or 80 Acres?

- Utah commission will decide the issue in November, and data from five Shell wells drilled on the closer pattern will have a bearing on its decision. Drilling contractors have big stake in outcome.

OIL operators will get a clearer indication next month of future drilling and production trends in Utah when a controversy over a spacing pattern for Aneth area is settled.

Most Aneth operators favor the present 80-acre plan. Shell Oil Co. and a few others, however, have appealed for a change to 40-acre development.

Engineers and attorneys for both sides currently are studying data compiled from five 40-acre test wells. The Utah Oil and Gas Conservation Commission allowed the wells to be drilled on the smaller pattern to produce the information.

Data obtained will be presented at a hearing November 10 when the issue will be decided.

Stakes high . . . The decision will have a definite bearing on drilling activity in the area.

Should 40-acre spacing be ruled, engineers estimate that 250 to 300 new wells would be drilled. Many 80-acre units would not be infilled because of the poorly developed pay. The wells cost in the range of $107,000 to $148,000.

This would mean a $27 to $45-million program for the drilling industry of the Rockies coming just at a time when well completions have dropped decidedly.

Last year an average of 21 oil wells was completed each month in Utah. During the past quarter, the rate has dropped to only 14 per month. In the Paradox basin, where the bulk of Utah's development work has occurred, the number of rigs has dropped to 12. These are completing about nine wells monthly.

Barring any major discoveries, development drilling will probably drop even lower due to the lack of proved locations. Aneth, which accounts for more than half of the state's crude production, has been contributing most of the drilling activity. And proved locations in this area have now been reduced to only some 55 spots. This year's crop of discoveries has led to little development drilling.

Production trends . . . Utah's crude production took an unusual dip in July.

From a peak of 118,500 bbl. daily in June, production eased off 5,000 bbl. daily in July. Current production is estimated by the Conservation Commission at 114,000 bbl. daily.

Whether this is a definite trend influenced by slowed-up drilling is too early to determine accurately.

Production trend previously had been steadily upward for several months. Economists say that the lower current figure is actually on the trend line and the July peak may have reflected unusually heavy production.

Utah's total oil output this year will be in the vicinity of 40,000,000 bbl. compared with 24,000,000 bbl. last year. Some operators claim that if an 80-acre spacing is retained and drilling fails to pick up, the production curve definitely will turn next year and the 1960 production total will dip to about 31,000,000 bbl.

Familiar battle . . . Density to which the Aneth area is to be developed has been a controversy since late 1957.

At that time Texaco Inc., Carter Oil Co., and Continental Oil Co. asked the Conservation Commission to order 80-acre drilling units. Shell and Gulf Oil Corp. objected, asking that the 40-acre spacing be retained.

From testimony presented at subsequent hearings, there appears to be little question it will be economic to drill the 5,700-ft. depth field to a 40-acre density. The disagreement centers around whether one well can efficiently and economically drain 80 acres.

Proponents of 80-acre spacing contend the porous zones in the limestone and dolomitic reservoir are reefs which interfinger and have good communication. The latter, they claim, is aided by a system of fracturing. Some minor pay intervals may be skipped in an 80-acre spacing pattern but the field's principal zones would all be drained.

Shell, on the other hand, sees the field as being composed of zones separated by impermeable barriers. Its geologists don't think reef material exists in the field, or that there is sufficient fracturing to give good communication.

As evidence that the reservoir is heterogeneous and that vertical communication is not good, proponents of 40-acre spacing point out the spotty results in some area. Good wells are ringed with marginal producers and dry holes in several instances. Many isolated lenses would be missed if 80-acre spacing is followed since only some 50% of the zones are well connected in most portions of the field.

Concerning the economics of 40-acre versus 80-acre spacing, advocates of the former claim the second well will result in 20% more oil being recovered from an 80-acre unit. This would more than pay for the cost of the second well.

Test wells drilled . . . Shell has completed five test wells on 40-acre spacing. Two are in Aneth proper and three in the Ratherford area. The locations selected were chosen so as to cover a variety of porosity and structural conditions.

The test wells were drilled with the understanding they would not result in any additional oil production for each 80-acre unit. Likewise all electrical logs and pressure and production data were made available to the 80-acre proponents for interpretation. All of the wells have now been pressure-tested and two have undergone production tests.

Details of what has been learned about the feasibility of 40-acre spacing are not available. Shell is saving this testimony for the November hearing. From data made available to the other companies, however, it is evident that at least one well encountered a thick porous section not revealed by surrounding wells.

Since purpose of the wells is to show that 40-acre wells will encounter porous lenses untouched by 80-acre wells, detailed pressure tests were run. Using Schlumberger's new wire line pressure tester, selective tests were made of all indicated pays. Conventional straddle tests were run to confirm zones that were continuous.

John Mecom Takes Aim at New Drilling Record

• Louisiana well projected to 26,000 ft. Driller hopes to avoid trouble by carefully planning his casing program.

The 25,340-ft. world's record-depth well, drilled in 1958, is going to be challenged.

John W. Mecom, Houston independent, is preparing to spud a projected 26,000-ft. well for himself and Mobil Oil Co. in South Louisiana. It is located just 8,000 ft. east of a previous world depth-record well, the 1 LL&E Humble "L," drilled to 22,570 ft. in Plaquemines Parish by Richardson & Bass in 1955.

Mecom is now the operator of the old Richardson & Bass well and recently drilled a 20,548-ft. well in the same vicinity.

The deepest hole in the world today is the 1-EE University, drilled by Phillips Petroleum Co. in Pecos County, Texas. Phillips drilled its well a year ago and subsequently abandoned as a 25,340-ft. dry hole.

The Phillips well ousted the Richardson & Bass well as the titleholder.

Mecom said last week that the projected 26,000-ft. well will be drilled with his Rig 25, which he described as the world's most powerful steam drilling unit. He hopes to have less trouble than other operators who have gone below 20,000 ft., because he will plan a casing program in advance. Casing has been a headache on deep holes in the past because the operator did not know at time of spudding he would be going to such depth.

The well will be located in the Homeplace field about 5 miles south of Port Sulfur. As an experienced operator in the area, Mecom wants to explore the deeper sands which he believes will find oil in sufficient quantities to pay back the high investment.

Mecom recently drilled a well located 5,500 ft. southeast that went to 20,752 ft., but was finally completed at only 15,300 ft. Efforts were first made to complete it at total depth (OGJ, May 18, p. 165), but these failed. The well is the John Mecom-Ed Hill Louisiana Land & Exploration Co. Unit No. 2, and Mecom is the operator.

Had the well been completed at total depth, it would have become the world's deepest producer. The old Richardson & Bass well once held that title at 21,443 ft., but later was plugged back to about 19,000 ft., where it produces today.

Gulf Gas Pledge Spurs Transwestern Plans

TRANSWESTERN Pipeline Co., with important support from its biegest natural-gas supplier, may start building its Texas-to-California line November 1.

If so, it will shoot for starting initial deliveries by next June.

Gulf Oil Corp., which will deliver more than half the gas for the line, agreed to commit its reserves to the project in advance of final price-determining hearings to be held by the Federal Power Commission.

Other suppliers have until October 23 to make their intentions known.

Pipeline contractors report they're still ready to start work if the gas producers follow Gulf's lead. Gulf is the parent company of Warren Petroleum Corp., one of the three promoters of Transwestern.

Mills Cox, Transwestern president, said the contractors—H. C. Price Co. and Houston Contracting Co.—are now reaffirming their construction schedules to fit a winter program.

"If they start by November 1, we think we will have the line completed in 7 or 8 months," Cox said. "We're shooting for completion and initial deliveries sometime in June, 1960."

New hope that work can start shortly stems from the FPC's modification last month of an earlier order granting authority to construct the line (OGJ, Sept. 28, p. 56).

The original order on August 10 reduced prices to be paid suppliers by 1 to 6 cents. The modified order granted requests for rehearing and stated that if the suppliers would commit their reserves ahead of the rehearing, construction could start.

Gulf quickly agreed to the proposal and accepted a certificate of public convenience and necessity from the FPC authorizing it to sell gas to Transwestern.

A Gulf statement said:

"Since Gulf will deliver more than one-half of the natural gas to be sold by producers to Transwestern, Gulf's acceptance of the certificate should assure the project.

It is believed that other producers will also accept certificates with the right under the commission's order to justify their contract prices in a reopened proceeding."

Suppliers which accept the FPC plan by October 23 will attend a prehearing informal conference on October 27 before an FPC examiner. They will begin making their case for contract prices greater than those approved in the August 10 order.

Sid Richardson: His Clan Dwindling

SID W. RICHARDSON, 68, multimillionaire Fort Worth oil operator, died September 30 at his ranch on St. Joseph's island 30 miles up the Gulf Coast from Corpus Christi.

Richardson was one of the most successful of the dwindling clan of colorful oil men who made, lost, and recouped fortunes several times in the first half of this century.

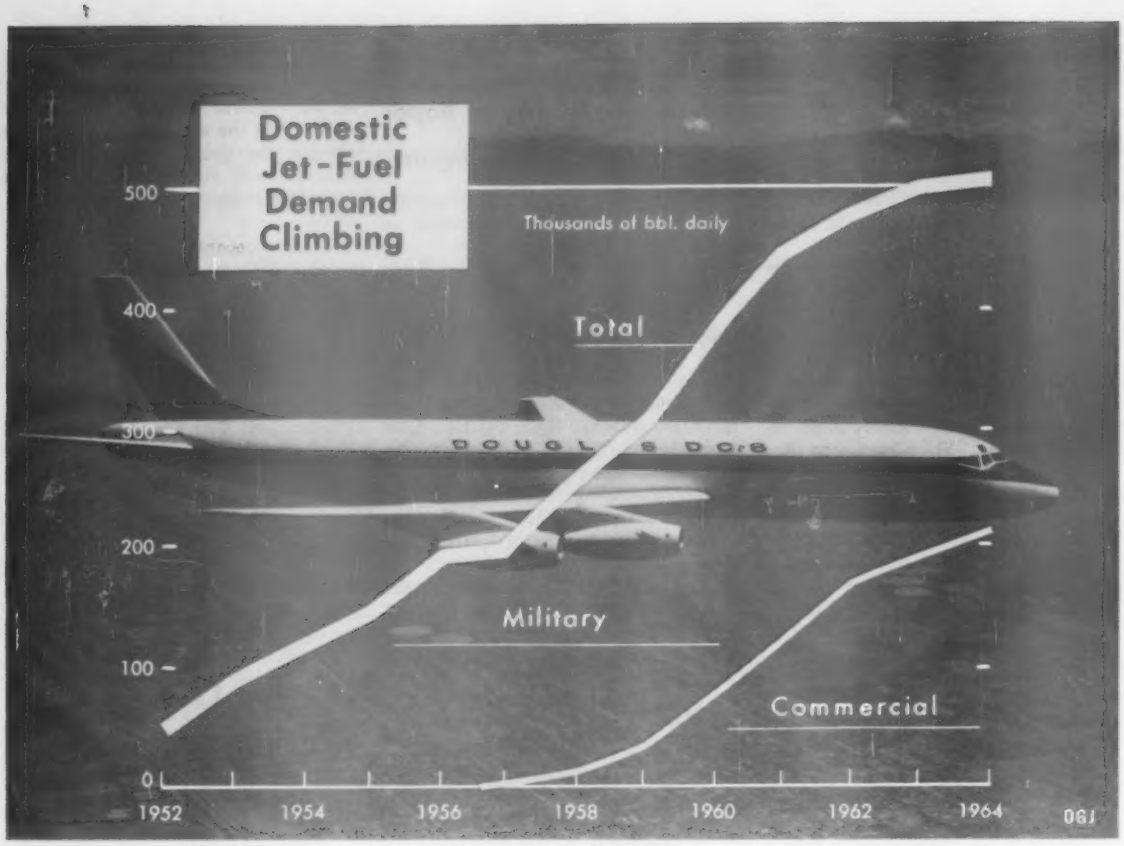
At his death from an apparent heart attack, Richardson's interests included producing properties in four southwestern states; carbon black, sulfur, and gasoline plants in West Texas; a large number of drilling rigs; and a refinery at Texas City, Tex.

Richardson was a close friend of Clint W. Murchison, Sr., Dallas. His first known oil dealings were in partnership with Murchison. They parlayed a $75,000 spent for leases in Burkburnett in North Texas into millions.

But Richardson went broke the first time soon after that when oil plunged to $1 a barrel in 1921. He rebuilt his fortune during the 1920's only to be wiped out again when the flood of oil from East Texas field hit the market in 1930.

Richardson set his sights high on West Texas. With equipment and even labor gained on credit, he built another fortune estimated as one of the country's largest.

Along with his oil properties, Richardson had extensive cattle-ranch and other real estate holdings plus other varied interests.



Jet-Fuel Demand Ahead of Predictions

- Total domestic demand is increasing for two reasons: Airlines are stepping up their orders for jet planes and the military failed to cut back requirements as much as expected.

John P. O'Donnell
District Editor

JET-FUEL demand will grow faster in the next few years than had been predicted.

The target for total domestic demand is now 500,000 bbl. daily by 1964. Current demand is about 300,000 bbl. daily.

The principal reasons for the brighter picture:

. . . Commercial jets and turboprops are coming into service faster than expected.

. . . Effect of the federal Government's economy wave on military requirements has been less than expected.

The influx of commercial jets and turboprops has boosted estimates of kerosine-type fuel requirements, particularly for the early 1960's.

A year ago, predictions called for jet and turboprop deliveries during 1959-61 to total 667 planes. Now it looks as if deliveries in this 3-year period will total 828—a 24% increase over the previous estimate.

The Government's economy ax isn't taking as big a cut out of military jet-fuel requirements as the industry feared at first. Therefore, military demand for the next few years will be greater than the economy measures threatened—but still lower than year-ago estimates.

A year ago, the military predicted its demand over a 5-year period, 1959-63, would average about 370,000 bbl. daily (OGJ, Oct. 6, 1958, p. 103). The revised prediction is now for an average of about 365,000 bbl. daily during that period—a drop of less than 1.5%.

That 1.5% drop is encouraging to the industry because a bigger cutback was feared. It's a bit like the man who expected a $100 raise, saw an economy drive threaten to take a healthy cut out of that, and then ends up with a $98.50 boost in pay.

The outlook . . . Total domestic demand for jet fuels will zoom past the 500,000-bbl. mark by 1964.

Just how much demand goes above that figure depends a great deal on the volume of jet fuel the military gets from foreign sources. For example, in fiscal 1957, foreign sources supplied 59,600 bbl. daily of total military demand of 261,100 bbl. In 1958, the foreign share was 79,400 bbl. of a total of 259,200 bbl. What the foreign share will be in the future is anybody's guess.

One thing is sure: Military demand will continue to outstrip commercial requirements in the foreseeable future. The public eye is spotlighted on pure jets and turboprops being intro-

INDUSTRY'S best jet-fuel customer—and will be for some years to come—is the U. S. military.

duced on new runs almost daily, but it will still be a couple of years before commercial demand tops 100,000 bbl. daily.

Total U. S. military demand—supplied by both domestic and foreign sources—is climbing fast.

Military requirments for fiscal 1957 were about 337,100 bbl. daily. Here's how it looks for the next 5 years: 1960, 346,000 bbl.; 1961, 357,000 bbl.; 1962, 378,000 bbl.; 1963, 398,000 bbl.; and 1964, 414,000 bbl.

While jet-fuel demand is climbing, avgas requirements are dropping slightly.

There are about 500 turboprops and 50 pure jets in operation, compared with 4,300 piston planes. Despite the big difference in number, domestic jet-fuel demand is well ahead of avgas.

Total domestic demand for jet fuel the first half of this year was about 257,000 bbl. daily, compared with about 249,000 bbl. daily during the comparable period in 1958.

During the same period this year, avgas demand was about 201,000 bbl. daily, compared with about 203,000 bbl. last year.

Avgas was big business and many millions of dollars were spent during and since the war to add quantity and improve quality. But, from a volume standpoint, the best days avgas ever had will be dwarfed by jet-fuel needs when they fully mature.

Jet-Plane Orders Are Being Stepped Up

On order Sept. 15, 1959, for delivery in:

	1959	1960	1961	1962	1963	Total
Jet Transports	132	298	65	0	59	554
Long-range Turboprops	118	66	25	0	12	209
Medium-range Turboprops	113	11	0	12	0	136
Total	*363	375	90	12	71	899
On order 9/15/58	284	339	44	15	59	741
Increase	+79	+36	+46	−3	+12	+158

*Includes planes already delivered in 1959. SOURCE: Esso Air World Survey.

Supply problem? . . . There's no supply problem for kerosine-type fuels in immediate prospect, but there may be a threat of short supply in years ahead.

Commercial demand — which is principally for kerosine-type fuels—this year is running about 36,000 bbl. daily. It is slated to grow rapidly in the next few years.

At the same time, the military—which principally uses gasoline-based fuels—will be taking more and more JP-5, a high flash point kerosine-type fuel. The military expects to increase its use of JP-5 five-fold in 5 years.

Combined commercial and military demand for kerosine-type jet fuels then could reach 250,000 bbl. daily by 1964. That's seven times the current demand.

It's possible by that time that good kerosine crudes will be as sought after as good gasoline crudes are today.

Types of fuel . . . Since the military is sticking mainly to gasoline-based fuels and the commercial airlines to kerosine-type fuels, there will be little conflict between the two.

However, that doesn't mean there will be no fuel problems. Both military and commercial buyers want fuels that will do things present fuels won't do.

One thing the military is concerned with is the explosive hazard of storing and transporting gasoline-based JP-4.

Steps taken to reduce these hazards include use of underground storage as much as possible to reduce temperature changes. Bulk storage is being kept in floating-roof tanks, and satellite tanks are being set up close to fueling facilities. To reduce turbulence, the military is using large-diameter lines, tangential tank loading 4-in. loading lines compared to the 2½ or 3-in. lines in commercial service, and reduced flow rates.

There also are problems connected with kerosine-type fuels. One is their affinity for water and the presence of

dirt particles. Several oil companies have set up jet-fuel laboratories in an effort to lick these problems.

Esso Research & Engineering recently developed a device that will detect as little as 30 parts per million of free water in fuel. Previous devices weren't too indicative when water content falls under 100 ppm. With Esso's device, fuel samples are tested as the fuel is delivered to the plane. Water content is revealed by changes in color of chemical powders dropped into the fuel sample (OGJ, Aug. 31, p. 33).

Researchers also are working with filter manufacturers to develop more efficient filters. The researchers have designed loading trucks to reduce both dirt and water content of the fuel. Some are lining tanks and tankers to cut down on rust contamination.

Some of these problems might be lessened by low-luminosity fuels. Low luminosity is attained by increasing the paraffinic and decreasing the aromatic content of kerosine-type fuel. The resultant product, for example, has a lower affinity for water.

These fuels have not yet been used commercially. Whether they will or not hinges on the economics of airline operation. The fuels carry a premium of about 2 cents per gallon. They also fall in the gasoline boiling range and therefore are subject to a gasoline tax. This makes them less attractive to airlines.

This was pointed up at the SAE's national aeronautic meeting in New York last spring. Two Boeing Aircraft engineers said an effective—but not necessarily economical—way to reduce smoke when using water injection on takeoffs was to use high luminometer number fuel. Luminosity is rated inversely, that is, the higher the number, the lower the luminosity.

Today's commercial fuel runs about 45 to 55 luminometer number. Sights have been set as high as 150 luminometer number. This would mean careful crude selection or additional processing. Either would mean higher price.

Smoke reduction on takeoffs is one advantage of low-luminosity fuels. Another is that they have about a 3% higher B.t.u. content per pound. Thus, a Boeing 707 which carries about 100,000 lb. of fuel on a trans-Atlantic flight could possibly cut its fuel load to 97,000 lb. and add 3,000 lb. of payload.

However, the 3% gain in payload would have to offset a possible 20% gain in cost. This makes the economics questionable at present.

Several oil companies, including Texaco and Esso, have manufactured low-luminosity fuels. Estimates are that the industry could produce 50,000 to 60,000 bbl. per day. The fact that it's available but is not being used by airlines shows that wide use of low-luminosity fuels is still over the horizon.

Engine design . . . A new engine development designed to increase fuel efficiency is the turbofan principle. It means more air through the engine and results in greater thrusts.

American Airlines was the first to disclose plans to adopt this principle. American is buying 50 Boeing 707's and 25 Convair 600's. The 707's will be equipped with United Aircraft's turbofans and the 600's with General Electric's aftfans.

Pratt & Whitney will be out with the JT3D-1 engine—the first equipped with a turbofan—in July 1960. It has already set November 1961 as target date for an improved version.

Here's what Pratt & Whitney claims for its JT3D engines: "Range and economy are improved by substantial reduction in fuel consumption."

However, this doesn't necessarily mean that a plane will use less jet fuel. Instead of cutting back on fuel, the airlines will increase payload. The plane will be using the same amount of fuel as before, but it will be doing a better job. With four-engine pure jets costing about $5,500,000 and with annual fuel bills running up to $600,000, this adds up to better airline economics.

Pratt & Whitney's turbofan is a fan mounted in front of the engine to feed more air into it. GE's aftfan is mounted behind the engine to draw more air through it. Rolls Royce's Conway uses no fans but enlarges the intake to admit more air to the engine. All three enable the engine to gulp more air—which means greater thrust.

The military hasn't disclosed its intentions on the turbofan principle. But it's a good bet that it will be adapted to the B-52. Range and load are of utmost importance to these behemoths of the air. Fans would greatly benefit the huge planes, which have eight J-57 engines.

Servicing problem . . . Servicing jets is becoming more of a problem—and a costly one.

There was no need for pipelines for supplying terminals when piston planes, using avgas, dominated the airways. But it's changing now.

Miami International Airport is serviced by the Everglades Pipe Line, a 35-mile 8-in. line carrying jet fuel from the marine terminal at Port Everglades.

New York's Idlewild Airport has increased its storage capacity to 9,800,000 gal., half of that jet fuel. Both the storage and the distribution system will have to be expanded. When jets get into full swing, consumption at Idlewild is expected to be almost 2,000,000 gal. daily.

Although jets can be loaded at the rate of 1,200 gpm., it still takes longer to service a big jet than the biggest piston plane.

Here's a quick look at the problem: The Boeing Stratocruiser, at 600 gal. per hr., and the Douglas DC-7 and Lockheed Starliner, at 525 gal./hr., were the heaviest fuel consumers among commercial pistol planes. Both the Boeing 707 and the Douglas DC-8, tops in commercial jet liners, will consume 2,200 gal./hr.

Jet departures at Idlewild now average 25 per day. They are expected to increase to 250 daily in the not too distant future. The parking and service problem then will be severe.

PIPELINE BRIEFS . . .

A 600-hp. unit is being installed at the Manhattan, Ill., station on the Standard Oil Co. (Ind.) products line. Gardner Construction Co. and Crotzer Electric Service have the building and electrical contracts. The project will be completed around November 1.

A 128-mile 12-in. construction program is being completed this week by Great Lakes Pipe Line as part of a $10-million expansion of its products system. M-R Co. of Wichita, Kans., had the contract for the project from Iowa City, Iowa, to Middlebury Junction, Ill., which completes a 12-in. line from Des Moines to Chicago. Pentzien, Inc., installed a 3,100-ft. crossing of the Mississippi River at Princetown, Iowa.

A 42½-mile 8-in. LPG line will be completed next week by Humble Pipe Line. Company crews are handling the project between Kingsville and Viola, Tex. Humble also will start a 27-mile 10-in. products line from Baytown to Houston next week. This line is to be completed by the end of the year.

An additional 55,000,000 cu. ft. per day of gas will be added to Westcoast

New Tool Gives Quick, Permanent Frac Record

- **Running record of frac job provided by Halliburton's Fracometer.**

HALLIBURTON Oil Well Cementing Co. has developed a new data-recording tool that gives a visual and permanent continuing recording of vital factors in a well-fracturing job.

The new instrument is called the Fracometer. It's actually three instruments in one. When used with Halliburton's Densometer, it will provide recordings of:

. . . **Fluid injection rate.** This is measured in barrels per minute by a flowmeter.

. . . **Wellhead pressure.** This is accomplished by a pneumatic pressure pickup connection.

. . . **Hydraulic horsepower.** A pneumatic analog computer calculates the hydraulic horsepower delivered to the wellhead.

. . . **Ratio of sand** to fracturing fluid. The Densometer reports this ratio in terms of fluid density. It is an adapted version of the Densometer originally developed by Halliburton to weigh cement slurry and drilling mud.

Field reports . . . The Fracometer has been used in the Farmington area and on several wells in Oklahoma operated by Pan American Petroleum Corp.

Harry F. Conroy, Halliburton vice president in charge of field operations, gave this evaluation:

"For the first time since fracturing was introduced, the oil operator and the service company personnel have exact information on the progress of the fracturing treatment. This is better than even 'up-to-the-minute' information—all of the instruments respond and record their data within 10 seconds."

Job simplified . . . The four readings of the Fracometer are presented in visual gages and also are recorded on strip chart for permanent reference.

Conroy described fracturing as a high-speed operation and said, "Until the introduction of these instruments, computing data were necessarily delayed until conclusion of the job. Some of the factors were averages, even so, and had to be based on total sand and fluid consumption, and the like."

This information now is immediately available while the fracturing treatment is in progress. "This means the treatment may be modified on the spot if desired by the customer," Conroy said.

Conroy also pointed out that a treatment involving more than one injection rate, type of fluid, sand ratio, or other factors is simplified.

"These instruments might be described as a step toward ultimate automatic control of the variables in fracturing treatment," he declared.

ENGINEERS check strip chart recorded by Halliburton's new Fracometer, which is a new data-recording machine for fracturing jobs.

Transmission system with completion this month of a connection to fields in the Jedney-Bubbles area of northeastern British Columbia. Marine Pipeline & Dredging, Ltd., is laying 18 miles of 12-in. and 7 miles of 10-in. to extend the Westcoast line to new production 90 miles northwest of Fort St. John. Effective January 1 Westcoast will pay 9¼ cents per M.c.f. for Peace River area gas, almost 50% more than has been paid during the first 2 years of the pipeline's operation.

Some 47 miles of 4, 8, and 10-in. gas line will be laid in North Carolina by Public Service Co. of North Carolina. Bids on the construction are scheduled to be received October 10.

An increase in authorized export of natural gas from Alberta is being sought by Alberta & Southern Gas Co., Ltd., for a line to California. The Alberta Oil and Gas Conservation Board has been asked to amend a permit which now authorizes the new company to export 2.3 trillion cubic feet, or up to 400 million cubic feet per day. The new request is for 4.2 trillion and up to 500 million cubic feet per day for the $330-million project which will come before the FPC this month.

Also for Pipeliners . . .

IN THE NEWS: Gulf gas pledge gives Transwestern hope of starting Texas-to-California pipeline next month (p. 101) . . . California Standard drawing plans for Alaska's first pipeline (p. 106) . . . Phillips case again brings FPC face-to-face with issue of how to set field rates (p. 116) . . . Syria planning products pipeline system (p. 121).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are carried in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Guides for computer control of a pipeline (p. 172) . . . Iowa-Illinois pipeline is laid in 9 ft. of mud (p. 183).

Main Attack Near in Long Beach's Battle With

AFTER MONTHS of "skirmishing," operators in California's huge Wilmington field are about ready to launch a full-scale attack on land subsidence.

Plants with a daily injection capacity of more than 500,000 bbl. are available. By the end of October an additional 287,000 bbl. capacity will be available.

The actual water flood will not reach these volumes for several months, however. More injection wells will have to be drilled and connected to distribution systems which now span most of the subsiding area.

A million-barrel flood involving some 250 input wells is the ultimate goal. The flood is scheduled to reach this goal by the spring of 1960. However, operations are behind schedule based on the current injection rate of 225,000 bbl. daily through 75 injection wells. However, the fast rate at which injectors are being added—11 were added in the last 2 weeks of September—indicates the goal still may be attained.

Most recent plant completed is one of 157,000-bbl. capacity on Terminal Island, adjacent to the area of greatest subsidence.

WATER-INJECTION plants are going up fast in Wilmington field.

Largest injection plant is to be completed by late October. It will be capable of injecting 287,000 bbl. daily and will consist of eight 500 to 900-hp. motor-driven centrifugals.

In addition a 72,000-bbl. plant has been completed in the Port of Long Beach. The Pier E plant has been expanded from 73,000 bbl. injection capacity to 150,000 bbl., and one

Alaska May Have Deep Gas Strike on Kenai

- **Union executive tells Anchorage officials Union-Ohio test has proved reserves big enough to supply city.**

ALASKA may have a major gas discovery on the Kenai Peninsula south of Anchorage.

Anchorage newspapers reported a spokesman of Union Oil Co. of California announced there that the Union-Ohio 1 Kenai is an apparent gas discovery.

The Union official reportedly estimated the well is capable of supplying at least 10,000 M.c.f. daily and has proved enough reserves to supply the city of Anchorage for 20 years.

Anchorage reporters identified the Union official as Charles A. Smith, division manager of operations. Union operates the joint-interest Kenai well for itself and Ohio Oil Co.

He made his announcement at a public hearing considering a proposed gas franchise for the city of Anchorage. He was quoted as saying:

"We believe, based on the blowout which occurred in the drilling of our Kenai Unit No. 1 and a study of the electric logs run in this well, that we have substantial gas reserves to meet the estimated requirements of Anchorage Gas Corp. for the 20-year terms of its franchise."

Few details . . . This was the first public announcement of a blowout on the Kenai Peninsula well.

The well was last reported drilling at 15,018 ft., making it Alaska's deepest to date. The hole is cased to 3,078 ft., and 3½-in. drill pipe is being used.

Only other significant gas reserves in Alaska are those at Gubik on the Arctic slope.

Anchorage citizens go to the polls October 6 to vote on the gas franchise.

The city council has approved the proposal of Anchorage Gas Corp., headed by Robert B. Baldwin of Houston.

However, the matter must be approved by public referendum, and there has been some opposition. A key issue has been the matter of gas supply. But a commercial discovery by Union and Ohio at Kenai could solve this problem.

Smith also indicated that Union has reached an agreement with Anchorage Gas for the Kenai production. According to reports, Smith said, "We are committed to drill enough wells to fulfill the requirements of Anchorage Gas."

To get the Kenai gas from the wellhead to Anchorage would require about 165 miles of trunk line. If it's franchise is approved, Anchorage Gas should have the line in operation and gas flowing by December 1961, Baldwin was quoted as saying.

Baldwin estimated that Anchorage Gas would serve about 15,000 customers initially and about 20,000 by 1970. Initial requirements, according to Baldwin's estimate, would be about 10,000 M.c.f. daily.

Another project . . . The Kenai also may be the scene of Alaska's first major pipeline and tanker terminal.

Plans for such a $4-million project are on the drawing boards of Standard Oil Co. of California. They involve a 22-mile, 8-in. line from the Swan-

Subsidence

on Pier A has been boosted 18,000 bbl. to 70,000 bbl.

All were erected by the city of Long Beach, which will supply water for the entire operation. Unit operators will conduct the floods in the five main fault blocks.

Progress noted . . . Effect of injections already is being felt in the areas where the most water has been put underground. During the 12 months ended August 31, studies made by Harbor Department engineers showed:

. . . **No subsidence** occurred at the southerly end of Pier A, an area on the outer rim of the bowl-shaped sinking area.

. . . **Sinking was cut in half** in a large area extending to the southerly portion of the Naval Shipyards, near the area of greatest subsidence.

. . . **Center of the subsidence bowl** declined only 0.9 ft., the first time since 1946 that the rate has been less than 1 ft. per year.

Water injections in the area of greatest subsidence totaled about 63,000 daily last month. During October they are expected to average 136,000 bbl. daily, and by the year's end will exceed 210,000 bbl. daily.

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son River Unit on the Kenai to Nikiski on Cook Inlet. Terminal facilities at Nikiski would include a tanker loading wharf and 240,000 bbl. of storage.

Before Standard of California decides to go ahead with the program, the unit will have to have enough proved production to assure 3,000 bbl. daily for at least 5 years.

Currently, the 71,680-acre unit is making around 650 bbl. daily from the three wells. Production is trucked to Seward, where it is shipped by tanker to Cailfornia. Standard operates the unit for itself and Richfield Oil Corp. Standard and Richfield hold 89% of the interest in the unit, while Ohio and Union hold the remainder.

R. G. Follis, Standard chairman, said construction of the line might start this winter if the production goal is reached. Target date for completion would be December, 1960.

He also revealed that Standard plans to spend $3 million next year for exploration in Alaska. The company currently is drawing up agreements for a unit operation in the Soldotna area. This region, southeast of the Swanson River Unit, will encompass more than 70,000 acres of potential oil land, he said.

Texas Producers Open Fight

. . . seeking to force common purchasers of crude to buy from new fields. Outcome will affect future wildcatting.

BATTLE LINES are forming in Texas over the issue of whether common purchasers of crude in the state can be forced to purchase from new fields.

A hearing before the Texas Railroad Commission which should either settle this issue or set the stage for a court contest has been set for October 7 in Austin.

Seeking and winning the hearing were three San Angelo independent operators, Byron and Henry Hoffman and J. H. Buchanan.

Their petition seeks relief under the commission's broad far-reaching pipeline order of June 1958 from a highly unusual situation. They find themselves with a pipeline connection for a discovery well from which they have been unable to sell any oil.

The well, the discovery for the B. & H. Queen sand field of Crockett County, West Texas, was completed in October 1958 and has been shut in since. It is 6,000 ft. east of Halff field and 5,700 ft. west of Clara Counch field.

The Hoffmans and Buchanan are major operators in Halff. The gathering system in that field was built and paid for by the San Angelo operators. It is operated by Texas-New Mexico Pipeline Co. The Halff crude is purchased by Texaco Inc.

The independents, at their expense, laid a line to the B. & H. field discovery and connected it into the gathering system. This line also is operated by Texas-New Mexico. The petition contends that Texaco, however, refuses to buy oil from this field on grounds that it doesn't want to take on any purchasing commitments presently in new fields.

Intervenors flock in . . . This jabbed Texas independents into concerted action.

Last week, five state producer associations—the same five whose 1957-58 battle to force common carriers to connect more wells to pipelines resulted in the commission's June 1958 order—petitioned the commission for permission to intervene in the hearing.

They are the Texas Independent Producers and Royalty Owners Association, the North Texas Oil and Gas Association, East Texas Oil Association, West Central Texas Oil and Gas Association, and Panhandle Producers and Royalty Owners Association.

The associations contend that a common purchaser's refusal to buy "any" oil from a new field is a direct violation of Texas statutes enacted in the early 1930's. These laws require ratable taking of crude oil without discrimination between fields.

"If a common purchaser in Texas can elect tomorrow that it will not purchase any oil from any new field in Texas, without regard for the statutory prohibition against discrimination . . . then the days of the Texas wildcatter are numbered, as indeed is the future health and stability of the crude - oil - producing industry in Texas. If this were permissible, a common purchaser might decide it will only purchase in those new fields in which it is a producer or has a mineral interest," the petition said.

A common purchaser might contend, the associations argue, that it could not absorb all of the tendered production from a new field. But then it might be legally required to take such part of the tendered production as would make a ratable market without discrimination in favor of the purchaser's own production or that of other producers or other fields served by that purchaser.

Union Leaves API

. . . and WOGA because results don't match costs.

UNION OIL CO. of California has resigned from the American Petroleum Institute and the Western Oil and Gas Association.

Reese H. Taylor, Union's chairman of the board, reportedly told both organizations it was quitting because Union couldn't reconcile the results obtained with the costs.

A check with other California companies indicated this was apparently a strictly Union deal and wasn't a forerunner of any mass exodus from the two groups.

The move caught the rest of the West Companies by surprise. However, it is not without precedent on Union's part. The company resigned in a huff from the API's Oil Industry Information Committee and the WOGA's Oil Information Committee at the height of the bitter conservation-law battle in California in 1956.

Port Acres: Small-Tract Battleground

- **Texas-sized argument over well spacing being waged in Port Acres-Port Arthur area with small operators in one corner and larger operators in the other.**

- **Port Arthur may kill small-tract drilling in Port Acres by annexing the community, but courts still must decide future of Railroad Commission's Rule 37.**

Howard M. Wilson
Gulf Coast District Editor

IF YOU WANT to kick up a king-size argument on well spacing, take a trip to Port Arthur, Tex.

Within a few miles of Spindletop and in the shadow of two of the nation's biggest refineries, two gas fields have been discovered—one at the nearby unincorporated settlement of Port Acres and the other within the city limits of Port Arthur itself.

Three blowouts already have occurred in the two fields, and wells are still drilling in the backyards of homeowners who are taking advantage of Texas' Rule 37 exception which allows drilling on small tracts.

The Port Acres-Port Arthur story has focused the spotlight on the well-spacing issue. The Texas Railroad Commission has spoken its piece, but the courts will write the final chapter.

Whatever the outcome, the fact is that today the Port Acres field has 22 wells completed on approximately 160-acre spacing, while town-lot drilling has added five more completions on tracts as small as a fraction of an acre, and many more wells are drilling on small tracts.

The beginning . . . Wildcatter Glenn McCarthy wrote the first unfortunate chapter in the area. In 1941 he drilled a dry hole to 10,858 ft.—just 20 ft. short of one of the Gulf Coast's big gas-condensate fields.

Not until August 1957 did a driller succeed. Meredith & Co. brought in the discovery at 10,514 ft. and suffered a blowout in the high pressure (9,050 psi.) reservoir that took 10 days to control.

The Railroad Commission fixed a 160-acre spacing pattern and set the allowable on the basis of one-third for the well and two-thirds for the acreage.

This order might have caused little excitement except that the field moved into the housing developments of the Port Acres area—and that's when the action started.

Promoters worked the territory rapidly, and some leases changed hands five or six times—with each owner tacking on an override.

Under the controversial Rule 37, the Railroad Commission began granting drilling permits on small tracts—and the 160-acre operators quickly envisioned drainage of the reservoir on an obviously unequal basis.

A well on 1 acre, for example, had an allowable of one-third that of a well on 160-acres. In actual allocation, the one-third will dwindle to about one-fourth, but this is still far more gas than the amount in place beneath the tract.

Three of the larger operators quickly went to court to halt the Rule 37 permits. Individual lawsuits began last spring, and these culminated in a three-company effort last August. Pan American, Michel T. Halbouty, and Meredith asked the district court at Austin to overrule the Railroad Commission on a number of points (OGJ, Aug. 31, p. 28).

This and other cases are still pending, while the drilling goes on.

Annexation . . . As the drilling fever mounted, the nearby city of Port Arthur took note. Why not annex the little community? The idea was not new, but there was a new urgency.

Last summer the Port Arthur city council prepared to do just that.

This produced a rather weird result. To beat the drilling restrictions that would come with annexation, operators began moving in water-well rigs to start "good-faith" drilling on the small tracts near dwellings. At one time there were 20 such rigs in operation.

But the city council backed off from immediate annexation, and agreement has now been reached to postpone it until November.

AERIAL view shows three drilling operations in Port Acres.

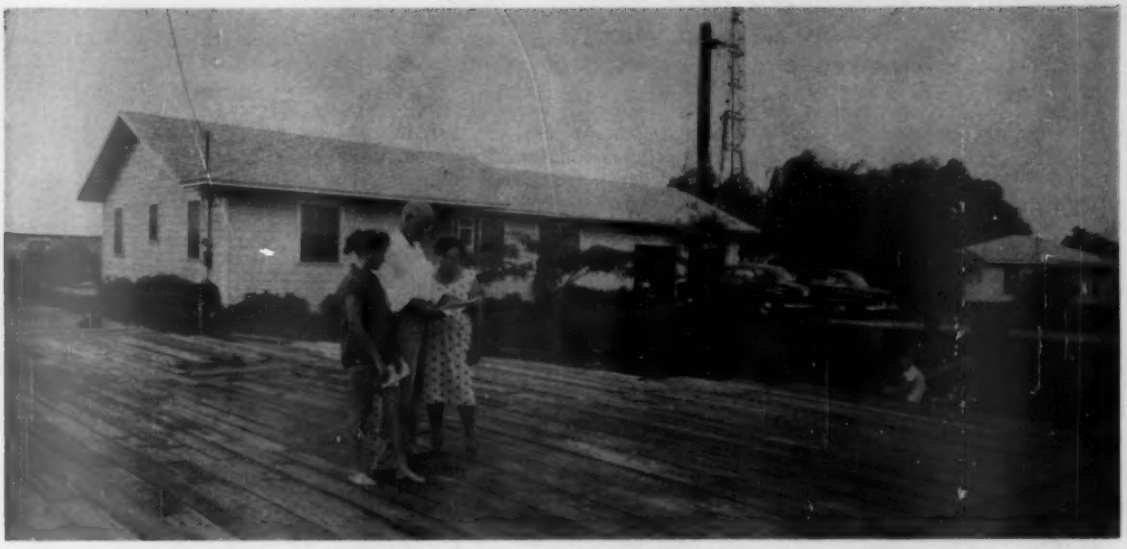
On the surface it appears surprising that the small Port Acres operators are not fighting annexation. But the economics of the oil business dictated their change of heart. Once an operator gets his own wells drilled or spudded, he becomes an advocate of no-more-drilling.

This is what has happened at Port Acres. The small-tract drillers are ready to call it quits on new wells.

Outlets . . . Currently the major operators in the field are hooked into the systems of United Gas Corp. and Texas Gas Corp.

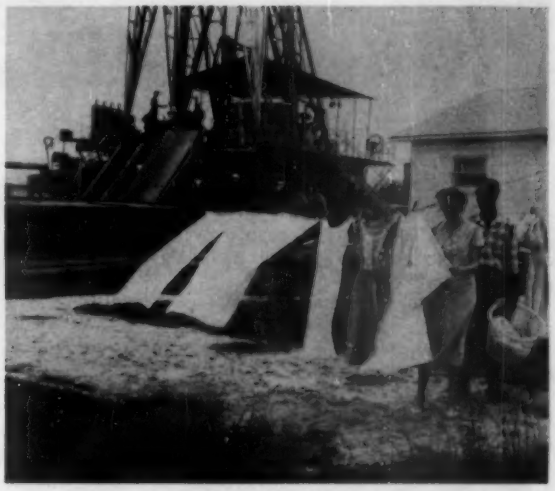
The five small-tract wells completed are shut-in, and the others now drilling have no immediate prospects for sale of their output.

The smaller operators give the im-



FLOORING has been laid in the back yard of the Port Acres home of Mr. and Mrs. Lester Arceneaux, shown with their daughter Linda. A drilling rig will be moved in soon.

DRILLING goes on two doors from Mrs. Calvin Meyers in Port Acres. A well is scheduled for Mrs. Meyers' yard.



OBLIVIOUS to drilling in the back yard, Mr. and Mrs. C. L. Lazenby, Port Acres, carry on domestic duties.

pression that they cannot get the deal they want from United Gas and Texas Gas, although they do not make the direct charge that the two pipeline companies will not talk with them.

Nonetheless, the small operators are negotiating with other pipeliners to move into the field and take their output. No deal is yet ready to announce.

Port Arthur . . . Meanwhile, a second gas field is rapidly developing in and near the city of Port Arthur, where city ordinance prohibits drilling within 1,000 ft. of any structure unless the owner consents.

A fault separates the two fields.

Because of the prospect of new wealth, the council has been pressured to loosen the 1,000-ft. restriction, but a new blowout in the Port Acres field, which soon will be within the Port Arthur city limits, probably nixed any chance for a change.

The blowout and fire, within the vicinity of several houses, burned five crewmen. The well bridged in 15 minutes but 24 hours later blew out again.

The earlier blowouts occurred on the discovery wells of the two fields.

Despite the inherent dangers in the high-pressure fields, few families have moved out. Apprehension, however, is considerable. At Port Acres, some wells are at the doorsteps of homes because of the necessity of drilling on a specified lot.

The defense . . . The smaller operator who is cashing in on Railroad Commission's Rule 37 is firmly convinced of the correctness of his own position.

One such operator, Herbert Dillon, Jr., of Houston, contends that "the majors made their own bed."

Dillon says the majors approved the 1/3-2/3 allowable formula at a time when they thought it would be to their own advantage—prior to the time that the reservoir was known to extend to the small-lot area.

The smaller operators, he said, acquired the small leases at considerable

expense and are drilling under the commission rules and the laws of Texas. To change those rules at this time would be grossly unfair.

"I am in favor of conservation but not confiscation," Dillon says. "Confiscation is a much bigger issue."

If the majors want to prohibit small-tract drilling, they must lease the acreage involved in advance and control it, Dillon said.

The majors . . . Halbouty voices the view of the larger operators.

"We recognize that the commission cannot deny small-tract applications," he says, "but it can encourage conservation by simply requiring that pressure be maintained.

"The order we sought would have simply said that no production would be permitted without necessary pressure maintenance. Prudent operators of small or large tracts then would be slow to develop until they had a workable agreement."

The Pan American - Halbouty-Meredith lawsuit charges that the field operators will suffer a $20-million loss because the Railroad Commission denied an application for a unitized cycling program to increase recovery of liquids by more than 7 million barrels.

The lawsuit charges also that excessive drilling under the 1/3-2/3 formula will deplete the field and that bottomhole pressure is declining at the rate of 3.5 psi. daily. The companies want production halted until the commission issues an order to maintain pressure and prevent waste.

Field facts . . . The Port Acres field has reserves of probably half a trillion cubic feet of gas under 3,200 acres, and Port Arthur field, with less than 1,000 acres, has approximately the same reserves.

The wells in Port Acres produce close to 3.5 million cubic feet of gas and some 55-60 bbl. of condensate daily. There is no Port Arthur production yet for lack of a pipeline tie-in.

The lower Hackberry is the only classified producing zone, although recognition of a second zone is sought by some of the small-tract operators.

Operators of the large-tract leases are Pan American, Meredith, Halbouty, Humble, R. H. Martin, and Peter Henderson. Among the small-tract operators are Dillon, J. C. Barnes, Midland; Gray Oil Co., Baytown; and Maverick Exploration Co.

watching WASHINGTON

Clyde La Motte

• An inside view of regulation . . .

"AN INDEPENDENT regulatory commission is not competent to regulate a vital national industry in the public interest."

This sharp indictment of regulatory commissions was made by a man who has been serving on one of them. He is Louis J. Hector, who resigned recently from the Civil Aeronautics Board.

In resigning, he wrote a memorandum to President Eisenhower spelling out what he feels are shocking weaknesses in the current regulatory approach.

He was talking primarily about the CAB, but he made it clear that the same criticisms apply to other commissions, such as the FPC, the FTC, and the ICC.

His sharpest charge was that the commissions do not —and seemingly cannot—formulate clear-cut general policies. As a result, there are few basic guides for the commissions, their staffs, and the industries involved. Instead, there is much groping in the dark in long, drawn out procedures concerning individual cases while the industry and the public suffer.

Hector considers the situation utterly hopeless as long as the independent commissions seek to serve as prosecutors, judges, administrators, and investigators all at the same time.

He makes these suggestions:

. . . **Transfer policy making,** planning, and administration from the independent agencies to an executive agency (such as the Department of Commerce in the case of CAB).

. . . **Transfer the judicial and appellate** duties of the agency to a special administrative court (such as tax courts which were established to specialize in tax matters).

. . . **Transfer investigations** and prosecution to an executive agency (such as the Department of Justice).

Under such an arrangement, broad policy would be drafted by the executive agency. Any individual situation not covered by this policy would be sent to the administrative court, and violations or failures to comply would be handled by the Justice Department.

Hector feels this approach would help clarify regulatory procedures and make them more workable. Too, it would help speed them up.

His vigorous proposals have created a considerable stir in regulatory circles. Some commissioners are known to agree privately with many of Hector's views.

Some members of the FPC, for example, have spoken of their growing frustration in trying to regulate the natural-gas industry in the public interest.

If the situation continues to worsen, there is likely to be increasing urgency behind the move to seek a new approach to regulation.

• FPC gives, and FPC takes away . . .

NATURAL-GAS producers won—and lost—in their skirmish with the FPC over whether they must waive their rights to put rate hikes into effect after a normal 5-month waiting period.

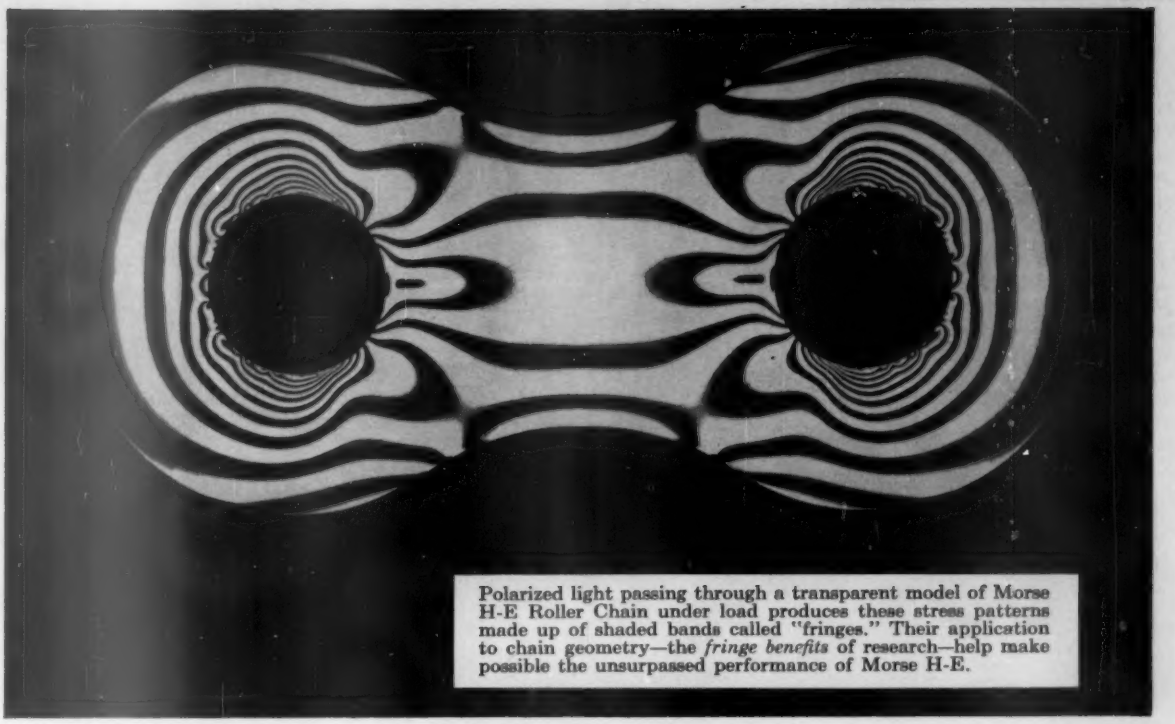
The issue came up in the FPC's consideration of the Transwestern Pipeline Co. case. The commission trimmed the initial prices from 1 to 6 cents per M.c.f., but gave the producers permission to file for higher rates immediately after certificates were granted—if the producers would waive their rights to put the hikes into effect at the end of the waiting period.

The producers protested that this was asking them to give up a right specifically granted them under the Natural Gas Act.

So, the FPC has now dropped the request for a waiver. Offsetting this producer victory, however, the FPC also withdrew its permission for the producers to file for higher rates. Instead, they will have to wait until their contract provisions call for a higher price.

The contracts do not specify any escalation for 10 years, but do permit price reconsideration after 4 years. At best, therefore, producers would have to wait for 4 years before they could file for higher rates.

The only real price hope left for the producers is that in the rehearings which the FPC is granting, they will be able to persuade the commission to accept the original prices agreed on between the producers and Transwestern. And that's a slim hope.



Polarized light passing through a transparent model of Morse H-E Roller Chain under load produces these stress patterns made up of shaded bands called "fringes." Their application to chain geometry—the *fringe benefits* of research—help make possible the unsurpassed performance of Morse H-E.

Photoelastic stress study shows . . .

"FRINGE" BENEFITS MAKE MORSE H-E CHAIN LAST UP TO 5 TIMES LONGER!

Improved design . . . special mechanical and metallurgical processes give Morse H-E a 95% higher endurance limit

"Fringes"—the shaded bands which make up photoelastic patterns—show the intensity and distribution of stresses set up in a chain link-plate model under load. Morse engineers first use this knowledge to improve chain geometry. Then Morse production engineers apply advanced mechanical and metallurgical processes to side plates. Result: Morse High-Endurance Roller Chain, with up to 500% longer life under repeated heavy loadings.

Special treatment makes Morse H-E cost about 10% more. Yet it pays for itself in what you save on replacement costs and rig downtime on deep drilling. It's a real oil-man's bargain!

Check your favorite supply store today, or write: Morse Chain Company, Dept. 22-109, Ithaca, N. Y. Warehouses in Casper, Wyo., Houston and Odessa, Tex., Farmington and Hobbs, N. M., Los Angeles, Calif. Export Sales: Borg-Warner Intl., Chicago 3, Ill. In Canada: Morse Chain of Canada, Ltd., Simcoe, Ont.

ORDINARY CHAIN BREAKS when the side plate tires from repetitive loading and unloading during the cycle around the sprockets. But Morse H-E Roller Chain has a 95% higher endurance limit . . . outlasts ordinary chain by up to 5 to 1 under repeated loading.

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A BORG-WARNER INDUSTRY

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ONLY MORSE OFFERS ALL FOUR: Roller Chain, Silent Chain, Hy-Vo® and "Timing"® Belts

PHOTOS IN THE **NEWS**

Earth Stilts

DRILLERS reach water too fast in sinking shallow source wells to supply salt water for the huge flood in California's Wilmington field. Some parts of the field are below sea level and ocean water flows from the hole while it still is being drilled. To correct this situation, earth fills of 6 to 10 ft. are erected and the wells spudded from them.

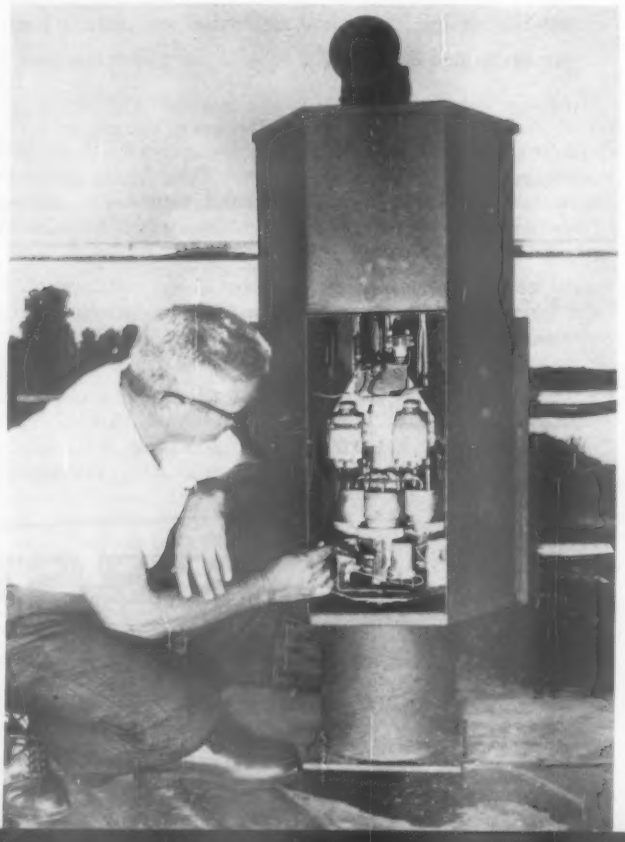
Drilling on the Level

AN AUTOMATIC self-leveling device has been developed by R. G. LeTourneau, Inc., for its offshore drilling platforms.

The safety mechanism consists of a pendulum arrangement for each leg. If the ocean floor beneath a leg begins to scour, the pendulum swings out and closes a photoelectric circuit. This sends current to blow a warning horn and start electric motors used in raising or lowering the platform on the sagging leg.

When platform is level again, the pendulum swings back to original position, opens the circuit, stops the leg motors, and silences the horn. A crew member formerly did all this manually.

In the photo, Engineer Louis Bell is checking the device aboard a LeTourneau platform nearing completion.



Learning Young

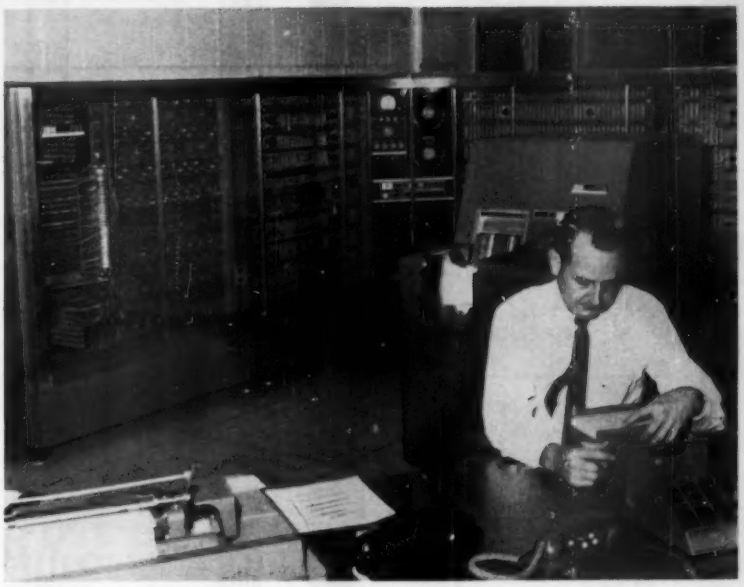
CLASSES of 300 high school boys will learn how to operate a service station or repair an oil burner in New York's newest school, the Thomas A. Edison Vocational High School in Jamaica.

Five "auto shops" make up the service-station section. Each will accommodate 50 boys at a time in learning engine and body repairs, how to treat customers, inventory control, and general service-station economics. A 3-year course also is offered in oil-burner installation and maintenance which includes the electronic controls that govern burner operations.

High Rent

EMPLOYES in Dallas of Mobil Oil Co. last week started using a huge new IBM 705 electric brain for high volume accounting.

In order to pay for its $43,000 monthly rental, the machine will: Check price and extension of 16,000 invoices of deliveries to service stations and other consumers covering about 1,300 different classes of products; produce daily sales summaries, sales analysis statements, customer sales records, statements and checks for 650 commission agencies, comparisons to quotas, and accounting entries; will adjust and price 35,000 gage tickets, calculate 50,000 royalty and working-interest checks, figure production inventories reports; and summarize pipeline receipts and deliveries.



Bon Voyage

THE EIGHT Bucyrus-Erie 22-B hoes and two draglines being lifted aboard ship at Duquesne Marine Terminal, Erie, Pa., are headed for a long voyage to a pipeline project in Iraq.

The machines were purchased by Turriff-Burden, Ltd., joint interest of British and American contracting firms. They will be used on two sections totaling 340 miles of the Kirkuk-Basra pipeline project for Iraq Petroleum Co.

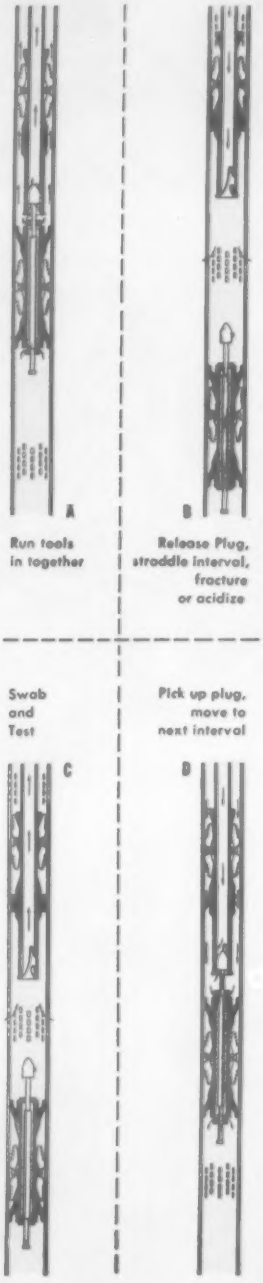
Here's what you can do with the **BAKER FULL-BORE RETRIEVABLE CEMENTER**

PERFORATE

FRACTURE ACIDIZE CEMENT

SWAB AND TEST

or use it with a **BAKER RETRIEVABLE BRIDGE PLUG** for as many straddle operations as required... in **ONE ROUND TRIP!**



here's why it does these jobs better...

HOLDS HIGH PRESSURES FROM ABOVE OR BELOW Contains two sets of opposed "Rocker-Type Slips". Once packing element is packed off, pressure from above or below is automatically transferred through the proper set of slips to the casing.

FULL-BORE (Tubing I.D.) permits passage of instruments, or guns; prevents "screen-out" during fracturing operations.

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Write for Catalog Supplements 319, 322, 323 for complete information on these products and their applications.

Pool To Be Revived

. . . by Humble with new production technique.

HUMBLE OIL & Refining Co. is planning a unique, intermittent pressure-maintenance program for a small oil reservoir in South Liberty field on the Texas Gulf Coast.

The plan involves injecting a slug of gas, then a slug of water, then halting injection and shutting in the well for a time, and finally producing the well until pressure declines to a point just above the saturation level. Then, the whole process would be repeated.

A Humble geologist, in a request for a permit from the Texas Railroad Commission last week, termed the program a "summit and basement type" injection program.

The reservoir involved, the EY-8A sand at 6,237 to 6,270 ft., is a one-well, 10-acre pool wholly owned by Humble.

L. M. Duhon, Humble engineer, said the company proposes to inject gas for about 2 months then salt water for about the same period. This should build up reservoir pressure, now about 1,700 psi., to about 3,300 psi. which should be high enough to flow the well.

The well, Humble's 16 E. F. Simms, would then be shut in to allow segregation of water, oil, and gas. It would be tested possibly 1 day each month to determine when the water had left the well bore.

When this happens, production would be resumed and continued until pressure had declined to just above the saturation level of about 2,200 psi. Then the cycle would be started all over again.

The well was completed in September 1956. It is an anticline formed by a salt dome. The pool, Humble says, has reached the end of its primary producing life after producing 13,490 bbl. The company estimates secondary oil resulting from the program will exceed the primary total.

Transco Plans 36-In. Loop

A $60-million looping program to increase mainline capacity from Texas to New York by 110 million cubic feet daily is planned by Transcontinental Gas Pipeline Corp.

Transco will ask the Federal Power Commission within the next few days for authority to install 36-in. loops and additional compressor horsepower on the 1,800-mile system. The looping will be the beginning of a third complete line.

Announcement of the expansion program was made in New York by Transco President E. Clyde McGraw and confirmed by the company's Houston headquarters. Details of the expansion will be disclosed in the FPC application.

Transco this summer completed three projects costing $80 million that will permit a 36% increase in gas deliveries to the New York-New Jersey area this winter. The company has available new storage at Leidy, Pa., and has completed a mainline to the metropolitan New York area and new offshore gathering lines in the Gulf of Mexico.

Texas Test Halted

. . . by stuck bit following gas kick from 15,000 ft.

A STRONG gas kick, usually the signal for much elation in a rank wildcat, has caused some miseries, too, at Mobil Oil Co.'s 1 Kathleen J. Moore.

This deep test in remote Pecos County, West Texas, is scheduled to 20,500 ft. to test the Ellenburger.

The 1 Moore first attracted industry attention when it found oil in the Wolfcamp in several tests between 10,890 to 12,450 ft. last June.

Early in September, with the bit at 15,017 ft., the hole started to blow gas from what is believed the Pennsylvanian. The blowout preventer was closed and the heavy gas kick controlled—but not without ill effects.

Drilling mud was so badly cut with gas that the hole through the Wolfcamp section caved and stuck the bit firmly on bottom. To date, operator has been unable to free it. And it appears the fishing job might prove a tough one.

Mobil was unable to estimate the gas volume flowing during the blow. It plans tentatively to run drill-stem tests when the hole is cleared.

The wildcat, in Section 19, Block 48, T-8, T&P Survey, is about 22 miles northwest of Fort Stockton in an area that has seen only scattered testing—most of it to depths under 10,000 ft.

Nearest production is about 15 miles to the southeast in Fort Stockton field.

PROCESSING BRIEFS . . .

A 170,000,000-lb. per year expansion of polyethylene production facilities is slated for Union Carbide's Seadrift and Texas City, Tex., plants. Only last month the company brought on stream an 80,000,000-lb. per year plant at Whiting, Ind. Completion is set for 1961.

Commercial production of polypropylene has begun at Texas Eastman's Longview, Tex., plant. The product, marketed under the trade name "Tenite," is being made in grades for extrusion and molding in both natural and colored forms.

Shell Chemical Co. has contracted with American Cyanamid Co. to produce Shell's new polystyrene thermoplastics in Cyanamid's Wallingford, Conn., plant. Production will start on a small scale this year to confirm Shell's pilot plant results.

The world's first commercial plant to use Standard of Indiana's polyethylene and copolymers was dedicated last week. The new plant, operated by Furukawa Chemical Industries Co., Tokyo., will have a capacity of 20 million barrels per year.

An explosion and fire last week destroyed an 84,000-bbl. gasoline storage tank at the Charleston, S. C., bulk plant of the Carolina sales division of Esso Standard. The loud blast and 250-ft. flames startled the Charleston area, already jittery from Hurricane Gracie. Esso's refinery across the road from the bulk plant was not threatened but was delayed from going back on stream after a precautionary shutdown during the hurricane.

Also for Refiners . . .

IN THE NEWS: Domestic jet-fuel demand is increasing faster than expected as airlines step up their jet orders (p. 102) . . . World crude output hits slump due to big drop in the U. S. and Venezuela (p. 122).

PLUS THESE TECHNICAL REPORTS: Refinery instrumentation and control (p. 127-140) . . . Refinery cost indexes (p. 159) . . . Humble attacks pollution at Baytown (p. 176).

Phillips Case Back in the Lap of the FPC

- **During oral arguments, Phillips stressed importance of decision on all the nation's gas producers.**

AFTER HEARING oral arguments last week, the Federal Power Commission is now face to face with the problem of making a decision in the Phillips gas case.

Just when the five members of the commission will reach a point of agreement is difficult to estimate, but few observers expect any decision before next January at the earliest—and it could be many months beyond that.

The intense interest in the case was obvious by the crowd that filled the hearing room in Washington during the 2-day session.

Phillips, in presenting its view, underscored the fact that the nation's producers would consider the Phillips decision as an indication of the treatment they, too, would get.

Phillips' attorneys, H. K. Hudson and Kenneth Heady, put most of their stress on this point.

The level of natural-gas rates must be high enough to assure a "total effort" by the gas producing industry if the industry is to meet increasing consumer demands, Phillips argued.

Phillips did not propose a specific method for determining rates, but it said the rates must enable the company to recover at least its total cost of service—including a rate of return, tax treatment, and allocation of cost which would encourage Phillips to continue to search for and develop new sources of gas.

"To fix rates on a basis which barely avoids confiscation of property will lead to the liquidation of the gas producing industry, and the pipelines and distributors will go with it," Phillips said.

After hearing Phillips, the commission listened to others, including representatives of state commissions.

For the most part, these spokesmen disagreed with Phillips and agreed with the ruling made by FPC Examiner Joseph Zwerdling in an earlier stage of the case.

Gulf to Absorb Western Gulf

GULF OIL CORP., which went through a major consolidation last year, is further streamlining its organization.

Western Gulf Oil Co., Gulf's West Coast operating subsidiary, is going out of business. Its duties will be assigned to the Denver division with the California operations coming under an area office designation.

With the new setup, Gulf's 7,500-bbl.-daily production in California will be handled by a production office in Bakersfield. The only activity slated to remain in Los Angeles, Western Gulf's headquarters, is an area exploration office—with Gulf Oil Corp.'s name, not Western Gulf's, on the door.

Western Gulf now reports directly to Houston, as do other Gulf division offices.

No date has been set for Western Gulf's official demise. A company spokesman indicated only that it would be in "several months."

A number of significant personnel switches will be made, including: H. B. Leeton, Western Gulf's production manager, to New Orleans; L. E. Warren, Western Gulf manager of exploration, to district exploration manager in Denver; Glenn V. Kersten, area superintendent at Bakersfield, to Wichita as area superintendent for Kansas.

In addition to dissolving Western Gulf, Gulf is downgrading its Evansville, Ind., operations from a separate division to an area office reporting to Oklahoma City.

Rumor revived . . . This move by Gulf revived the recurring rumor that Gulf was about to start exercising its right to convert the $120 million in debentures it holds from Union Oil Co. of California into Union common stock.

Under terms of the 1956 deal, Gulf can convert the debentures into 2,400,000 shares of Union's 7,331,790 shares of common stock outstanding (OGJ, Apr. 9, 1956, p. 67). This would be enough to pretty well put Union under Gulf's control.

The seers point out that with control of Union, Western Gulf would be unnecessary in Gulf's operations.

INDUSTRY BRIEFS . . .

Hughes Tool Co. last week filed suit in Houston charging Reed Roller Bit Co. with infringing on four rock-bit patents. Reed quickly denied the charge. The case was assigned to U. S. District Judge Joe Ingraham.

Work has begun in New York on United Engineering Center, the world's largest engineering center. The center will house the headquarters of 18 major engineering societies. The new structure is scheduled for completion in mid-1961. Ground-breaking ceremonies were held last week.

Importers have until November 2 to make application for oil import allocations for the first half of 1960. The Oil Imports Administration is mailing application forms to importers of record. Anyone not receiving such forms can get them by writing to the OIA, Interior Department, Washington, D. C. Late applications will not be accepted.

Mobil Oil of Canada has acquired a 15% interest in 1,300,000 acres of producing properties in central Alberta. Mobil purchased the interest from Royalite Oil Co., Ltd., for $2,500,000 and 50% interest in 36 oil wells in southeast Saskatchewan.

The drilling and well completion research building at Jersey Production Research Co., Tulsa, is being enlarged. The new addition will provide additional mechanical engineering and chemical laboratories. When completed, the enlarged building will have 13,000 sq. ft. of space and will house about 40 employees of the drilling and development division.

Bids made on 8 of 23 offshore tracts netted only $2,874,690 in bonus money for Louisiana in its recent lease sale. Total sales on the 191 tracts offered yielded only $12,088,304. Only bid to top $1 million was offered by Humble Oil & Refining Co. The company acquired 3,900 acres in Block 66, Ship Shoal area, for $1,297,550, an average of $332.71 an acre.

Passes even the "white glove" inspection— Thanks to Dowell's new standard of cleanness

You may never have occasion to place "white glove" requirements to the cleanness of your process equipment, steam generators, tanks and piping. But, if you do need this high degree of cleanness, Dowell can now offer it — as an additional service — in the chemical cleaning of *your* plant equipment.

Dowell developed these new standards in cleaning the piping networks of the missile launching facilities at Cape Canaveral. Combining the research and engineering facilities of the entire company, Dowell perfected new techniques, materials and equipment to meet the necessary rigid specifications.

This new service is now adaptable for use in all types of American industry. For example, Dowell recently performed an intricate cleaning job on a 3½-mile-long buried pipeline. The customer wanted to convert the six-inch line from hydrocarbon gas to carry oxygen. For this pure product the line had to be immaculate—free of all foreign materials. The plant was faced with the alternate of laying new pipe—a six week job at a cost of $150,000.

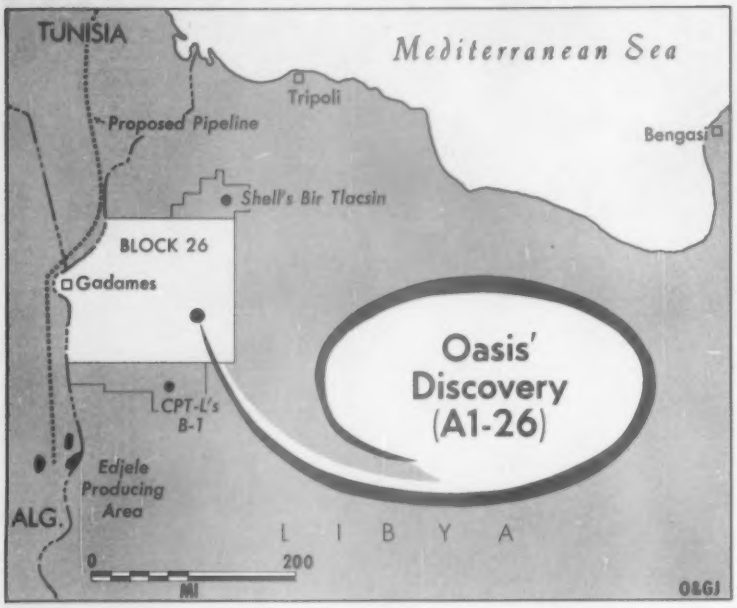
Using their new standard of cleanness, Dowell cleaned the line of hydrocarbon residues, carbon black, grease, mill scale, and rust. Meanwhile, plant crews made mechanical alterations to the line at a cost of about $25,000. Dowell's charge was $20,000; the job was done in 3½ days.

The job was satisfactory in every way. Inspection showed the line was free of all foreign matter. The customer credited Dowell with saving them about $100,000. Also the plant made additional profits because the line was put back into use so quickly.

Ask your Dowell representative about these new standards of cleanness and their possible application to your problems. This exclusive Dowell service may save you important money. Dowell, the pioneer of chemical cleaning, has 165 offices to serve every major industrial center. Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY



Oasis Hits Again in Libya

. . . but this time it's in the western part of the country.

First wildcat in concession along border is a discovery.

LIBYA chalked up another wildcat discovery last week as the North African country's intensive exploration play continued to pay off in oil.

The newest significant find was made by Oasis Oil Co., already one of the country's most successful companies. The wildcat is almost certain to swing at least some of the Libyan focus back to the west after a whole series of startling discoveries in the eastern portion of the country.

Oasis tested 40°-gravity oil in a 40-ft. Mississippian sandstone horizon in the first test of a 20,686-sq.-mile concession along the Libya-Algeria border. The well, 250 miles southwest of Tripoli, is more than 350 miles west of the concession block on which Oasis has already established a commercial field.

Oasis, a wholly owned subsidiary of the Ohio Oil Co., operates Libyan concessions totaling 62 million acres in which Ohio Oil, Amerada Petroleum Corp., and Continental Oil Co. each hold an undivided one-third interest.

The company said that 40°-gravity crude reached the surface in 20 minutes during a drill-stem test of the 5,719-740-ft. interval.

In a previous test of the 5,699-5-720-ft. interval, 37°-gravity crude rose 2,570 ft. in the drill stem in 90 minutes. There was no water in either test. The well is now drilling ahead in shale below 6,200 ft.

New interest in west . . . The new Oasis find may be the mid-point in a straight line series of Western Libya discoveries that stretches for 300 miles north-northeast.

The new well is about 150 miles south and slightly west of Bir Tlacsin, the Shell discovery. Shell says this well should be good for 1,000 bbl. daily and it's still testing. Last week, after it was drilled to a total depth of 13,178 ft., the well was plugged back to 9,450 ft. for further testing. The initial drill-stem tests which labeled the well a 1,000-bbl. discovery were made at about 8,800 ft.

Another 60 miles south-southwest of the new Oasis find is the French B-1 which indicated months ago that it was good for about 100 bbl. daily. This well was drilled by CPT(L), an affiliate of Cie. Francaise de Petrole.

Further southwest another 100 miles, but still in a direct line, is the Esso discovery at Atshan, Libya's first. Esso regards Atshan as noncommercial under present conditions.

Amoseas completes one . . . In the north central region of Libya south of the Gulf of Sirte, American Overseas Oil Co. last week completed its Beda B-1-47 for 3,650 bbl. daily and moved its rig to a 5-mile stepout.

Amoseas, the exploration company for the Caltex group, had previously drill-stem tested the well at the rate of about 1,280 bbl. daily (OGJ, July 27, p. 116).

The Beda 1 flowed 36.6°-gravity crude through the tubing at the 3,650-bbl.-daily rate. It was drilled to 5,107 ft. and then plugged back to 4,110 ft. where it was completed. Beda 2 is spudding 5 miles north of the discovery.

The Beda discovery is 265 miles south of Bengasi, but only 132 miles south of the Mediterranean coast to the north. It is about 60 miles southwest of Esso's prolific Zelten discovery and about 100 miles southeast of the already established Oasis production in Block 32.

The Beda well is on a 1,600-sq.-mile concession, one of eight held jointly by California Asiatic Oil Co. and Texaco Overseas Petroleum Co.

Two Drilling Ships

. . . are added by Zapata.

Nola I heading for Paria.

ZAPATA Off-Shore Co. disclosed last week it is completing two new floating drilling ships and that its first one, the Nola I, will arrive this week in Venezuela's Gulf of Paria to start operating there.

George H. Bush said the Nola II is scheduled for immediate towing to Mexico's Bay of Campeche to drill for the Pauley interests and that Nola III will go to work for the CATC group off Louisiana shortly.

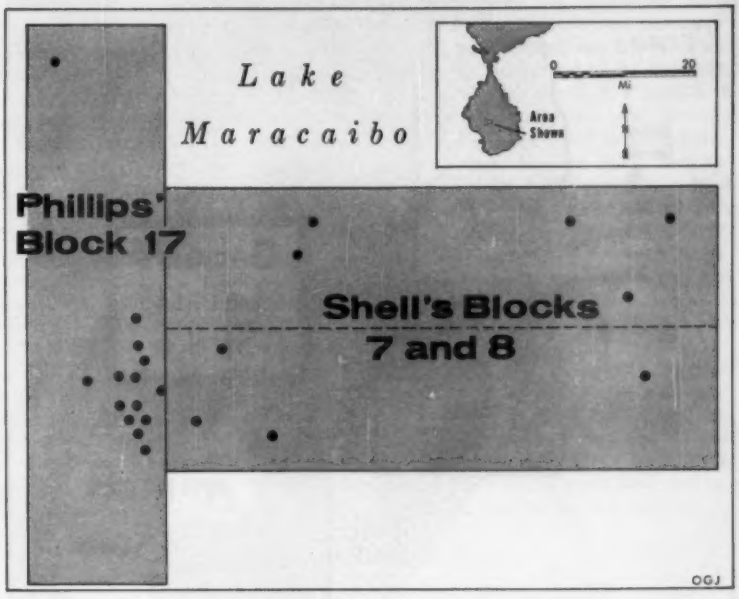
The two new vessels, like the Nola I, are converted YF barges and do their drilling over the side with no platform of any kind.

The Nola I has drilled successfully in recent months off Louisiana for CATC (OGJ, Mar. 30, p. 102) and will now move into Venezuela waters for Paria Operations, Inc.

Bush said he expects to keep the Nola I busy for a year drilling in Paria. A Loffland Brothers rig which has been drilling for the Paria group is moving to a concession of Pan American Petroleum Corp.

Offset-Drilling Scrap Flares in Maracaibo

- Heavy drilling done by newcomers forces Shell to drill for oil it doesn't need at the present.



A STRUGGLE shaping up in Lake Maracaibo points up one of the prime production problems in Venezuela today.

An old-line Venezuela company is moving two drilling rigs into lake property to develop production it doesn't need at this time—all because a new Venezuelan crude-hungry group has established a good field offsetting the old company's acreage.

It all started in 1957 when Phillips Petroleum Co. and seven partners paid a whopping $32,349,837 bonus for the 24,710-acre Block 17 offered for competitive bidding by the Venezuelan Government. The block is the southwest corner of all the lake territory now under concession. Open acreage lies to the west and south.

A short time before, Cia. Shell de Venezuela, the country's second biggest producer, paid $38,922,192 in bonuses for two blocks, 7 and 8, which are adjacent and at right angles to the Phillips' block to the east.

By January 1958, the Shell company had drilled three wells on the two blocks, all of them bottomed below 13,300 ft. and "suspended."

Less than a year later, Phillips moved into the block to the west. After drilling one dry hole in the north part of the block, the rig moved to the south half of the tract and began to drill one producer after another.

The Phillips' wells tested from 6,600 to more than 7,000 bbl. daily and some found as much as 450 ft. of net Eocene pay. Phillips now has two rigs running in the block and is producing about 45,000 bbl. daily from the lake property.

To the east, the old and well-established Shell company watched the Phillips' progress with mixed feelings. Shell has more than 300,000 bbl. daily of shut-in production in Venezuela. Industry observers in the country have little doubt that the Shell wells drilled on its two blocks to the east of the Phillips' operations are potentially productive. Shell has never said.

Last week, the dam broke. Shell revealed in Venezuela that it is moving a rig up to drill locations at the west end of its two blocks and offsetting the field which Phillips calls Lake 14-3.

Phillips countered with the news that it plans to offset its own successful wells, moving closer to the common concession boundary.

Rig to be added . . . A sidelight on the problem is that the new drilling activity will put another rotary in operation in Venezuela where drilling has dropped off steadily.

Phillips had already planned to move one rig to its Block 10 concession for a test in the northwest corner of the block offsetting a deep Creole Petroleum test to the north. This rig will now be replaced in Block 17 with a third rig.

Shell will have two rigs at work in the west end of its two new lake blocks and plans to move a third in later for exploratory drilling in the remainder of the 49,420-acre tract.

The Shell blocks are owned outright by the Royal Dutch-Shell company in Venezuela. Phillips owns 55.75% of Block 17 and is the operator for the group of partners. The partners include Sunray Mid-Continent with 17.27%; Ashland Oil & Refining with 10.79%; Western Natural Gas and El Paso Natural Gas with 6.47% together; Kerr-McGee with 5.40%; and Pacific Petroleums and Canadian Atlantic Oil with 4.32% together.

Each partner under the agreement takes or markets his share of the produced crude. The oil is apportioned on the basis of the percentage ownership.

Superior May Halt Maracaibo Drilling

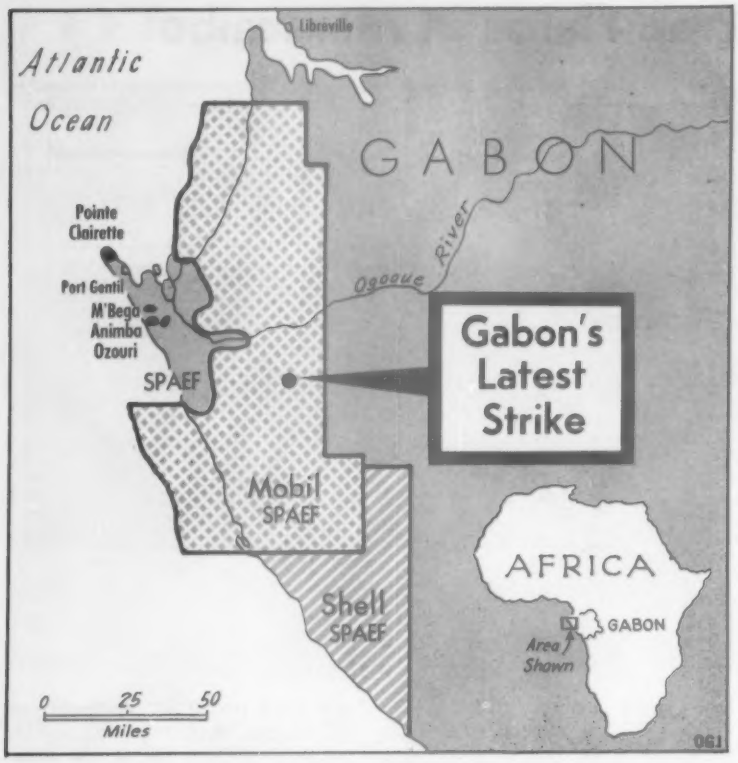
AN ALREADY gloomy drilling picture in Venezuela may darken even more because the U. S. Justice Department frowns on the Texaco-Superior merger.

The day after the two companies announced merger plans were off because of government opposition, H. B. Keck, Superior president, said his company will probably stop drilling in Lake Maracaibo.

Keck told his stockholders there's little point in drilling more producers when the company is having trouble selling the oil it can already produce.

Superior probably can produce 100,000 bbl. daily from its 27-well Lama field in the center of Lake Maracaibo. The company has produced as high as 70,000 bbl. daily from the small field. Keck said last week Superior is only selling 10,000 to 12,000 bbl. daily now.

The company's producing activities were shut down throughout September. Only about 5,000 bbl. daily was produced in tests of Lama-28, the most recent well completed in the lake block.



Gabon Strike Boosts Outlook

. . . for small West African country. Mobil and SPAEF find is inland from present producing fields on the coast. The nearest field is 45 miles from the discovery.

PROSPECTS of the little West African republic of Gabon becoming a major oil producer were brighter last week after a French-American combine tested a promising rank wildcat in Gabon's interior.

Gabon is already producing a steadily rising and respectable 15,000 bbl. daily. All the present production comes from coastal fields.

The new wildcat, Rembo Kotto No. 1, tested at the rate of 340 bbl. daily of high gravity crude from a pay found at 2,000 ft. The well is being deepened in an effort to test underlying formations.

The new test is 45 miles southeast of the country's present production. It is in a region in which the French company, Ste. des Petroles de L'Afrique Equatoriale Francaise (SPAEF), a year ago took on two Mobil Oil international affiliates as partners (OGJ, Oct. 6, 1958, p. 123 and Oct. 13, 1958, p. 87).

The two Mobil companies, Mobilrex and Mobil Exploration Equatorial Africa, Inc., plan to spend from $22.5 million to $45 million during the next 5 years on an exploration program in the area. Under the agreement with SPAEF, the two Mobil companies share a 50% interest in any production found. SPAEF is the operator for the partnership.

Productive fields . . . Gabon's four established fields: Pointe Clairette, M'Bega, Animba, and Ozouri, are all located along the Cap Lopez peninsula which juts northwest into the Atlantic from the Gabon coastline.

The most southern of these fields, Ozouri, is 45 miles northwest of the new discovery. All the existing fields produce from Eocene pays found from 2,000 to 4,000 ft.

It was just a little more than a year ago that SPAEF retained the region surrounding this productive area for itself and entered into partnership agreements with the two Mobil companies and a Royal Dutch-Shell affiliate.

The Mobil companies have a 50% interest in 3,191,000 acres in Gabon and in another 2,984,000 acres to the south in the Congo. SPAEF retained a separate area surrounding its Pointe Indienne discovery in the Middle Congo.

The Shell-SPAEF joint agreement covers about 990,000 acres adjoining the Mobil Gabon acreage on the south.

Since the joint agreements were made SPAEF has kept four rigs busy wildcatting in the country, two medium rigs in the region to north of the Ogooue River, and two heavy rigs to the south in the general area of the new discovery.

Under the terms of the joint agreement, the Mobil companies are conducting seismic work in the offshore areas under the SPAEF concession. If promising structures are located in the shallow waters of the wide Continental Shelf, the Mobil companies will be the operators for marine drilling.

FOREIGN BRIEFS . . .

Natural gas from Lacq field in southwestern France may be delivered to customers in Switzerland. A committee to study the project is being set up by Swiss coal-to-gas plants, electric utilities, and manufacturing concerns. Gaz de France says it could start deliveries of 35 million cubic feet daily in 1961 through a pipeline to Basle and Geneva.

A wildcat on Cebu Island has been completed as a 72-bbl.-daily producer from two zones. The well, drilled by Republic Resources & Development Corp., could be the start of the Philippines first commercial production. The first of the two zones tested has flowed 35 bbl. daily through a ⅛ in. choke (OGJ, Sept. 28, p. 69).

Ireland's first refinery has officially gone on stream at Whitegate Bay, Cork. Initial throughput at the 40,000-bbl. plant will be about 30,000 bbl. daily, a small part of which will be exported. The owners are Esso Petroleum, 40%; Shell-Mex and B. P., 40%, and Caltex, 20%.

A new wildcat in Papua is drilling ahead at 1,016 ft. The well, 1 Bwata, is 15 miles northwest of last year's

Syria Planning Products Pipeline System

SYRIA is giving top priority to plans for a local products pipeline system and has temporarily sidetracked a proposal for a long distance crude line from new oil fields to the Mediterranean.

The Syrian branch of the UAR's general petroleum authority has drawn up specifications for a pipeline network linking a new refinery at Hons with tank farms in the Damascus, Aleppo, and Latakia areas. Foreign construction companies will be invited to bid on the projects.

A proposal for a 500-mile crude line from Karachuk field in northeastern Syria is still under consideration. But any crude exports from either Karachuk or from another new field discovered in the same area by a West German firm are expected to be at least 2 years away, and then on a small scale.

The economic benefits which Iran has enjoyed because of products pipelines has helped prompt Syria to plan a 6-in. network of its own. The 20,000-bbl.-daily Hons refinery currently is running about 15,000 bbl. daily to meet local demand. The plant's full capacity may not be fully utilized for another 4 or 5 years.

German find . . . Concordia, a subsidiary of the West German firm of Deutsche Erdol, has made a discovery at Suwaidiyah in northeastern Syria after five dry holes.

Details of the find have not been revealed, but the company's seventh well has been started to the south at Tchembe, and a location has been staked at Toneman.

One of the drawbacks to a proposed pipeline from Karachuk is that reserves have not been fully evaluated. The field does not appear to be a major find by Middle East standards. But the government has hopes of repeating the situation present in Egypt, where domestic crude is exported to earn foreign exchange, and foreign crude is imported to fill local demand.

One report is that Syria has approached Iraq Petroleum Co. about the possibility of sending Karachuk oil through the pipeline system carrying Kirkuk crude to the Mediterranean. Karachuk oil, however, at 22°-gravity and high sulfur content, is of poorer quality than Kirkuk oil, and IPC is cool to the idea.

Karachuk was discovered 4 years ago by an American independent, J. W. MenHall. Concessions covering 770,000 acres were canceled by the UAR last year, by which time Atlantic Refining and Portsmouth Steel had acquired an interest in the venture.

Three Bolivian Deals Readied

AGREEMENTS have been reached or are in final stages of negotiation for extensive exploration and drilling work on three concessions in southern and central Bolivia.

Contracts are being negotiated, and letters of intent already have been signed, between Uniao Brasil Bolivia de Petroles, a Brazilian company, and Kerr McGee Oil Industries Inc., requiring Kermac to provide management and engineering-type services on a 568,000-acre tract north and east of Camiri.

Officials of the Brazilian firm and Kermac will confer soon on detailed plans for development. UBBP hopes that drilling may be started within 10 months and that 10 wells will be completed within a 3-year period.

A pact calling for exploration work on 485,000 acres immediately north of the Kermac area has been signed by Petrolio da Bolivia, S. A., a Brazilian company, and Keplinger & Wanenmacher, petroleum engineering firm of Tulsa. A tentative $3-million drilling program during the first 4-year period by Parker Drilling Co. has been arranged.

Detailed plans for development will be outlined soon in a conference between Keplinger interests and Petrolia da Bolivia officials.

Atlantic Refining Co. will receive a majority working interest on 235,000 acres north of Santa Cruz from White Eagle International Oil Co. in exchange for exploratory work there. Atlantic has an option to drill a 10,000-ft. well before July 1961 to earn an 80% interest in the concessions. A gravity survey plus completion of photogeological and magnetic studies of earlier survey findings will be handled by Atlantic.

Puri discovery, where Australasian Petroleum Co. is continuing to test. The well is the fifth "helirig" operation in which Sikorsky helicopters were used to transport a rig in the joint Stanvac, British Petroleum, and local Australian operation.

The asphalt plant at Aramco's Ras Tanura refinery is now producing two grades of asphalt simultaneously. Changes in piping and the addition of high capacity centrifugal pumps recently doubled capacity of the 900-bbl. plant. The asphalt is used locally.

A request by Phillips Petroleum Co. for additional acreage in Jordan has been approved by the country's council of ministers. Phillips gave up drilling operations 2 months ago on its original concession area after five dry holes. It will pay $6,000 per year for the new acreage in addition to $75,000 per year for the original license.

French and German interests have formed a new, jointly-owned pipeline construction company, Cie. Europeenne de Construction de Pipelines. There is one French partner, Entreprise Charles Certoux, of Paris, and two German firms, Fritz Hirsch Rohrleitungsbau and Josef Haarkshorst, GmbH. Headquarters will be in Paris.

A wildcat in Southeast Turkey has been started by Mobil Exploration Mediterranean. The well, Sinan 1, is 43 miles east of Diyarbkir. An earlier test near Adana was a dry hole.

Bolsa Chica Oil Corp. was moving in to drill a fourth test on a 370,000-acre concession in Southeast Turkey. The new well will be spudded in on a site about 12 miles east of the recently abandoned 6,035-ft. 2A Hazro.

A look at Australia's oil bill shows why so many companies are taking risks to find oil there. Companies paid $220 million in the 1958/59 fiscal year as the f.o.b. cost of 215,000 bbl. daily of crude and product imports. Shipping costs added an estimated $76 million to the cost. Domestic demand has risen nearly 30% in 4 years.

World-Wide Crude Output Hits Slump

- **Slight increase in Middle East offset by big drop in the United States and Venezuela.**

FREE-WORLD crude production dropped nearly 450,000 bbl. daily in July, as summer doldrums hit operations in the Western Hemisphere.

U. S. output was off almost 300,000 bbl. daily, and Venezuela's down about 190,000 bbl. daily. Canadian production was off some, but overland shipments of crude to U. S. markets helped shore up the Dominion's output to some extent.

These shipments, which have been exempted from U. S. import controls, averaged 112,400 bbl. daily. This compared with 93,800 bbl. daily in June, and 68,300 bbl. daily in May.

Private companies developing Argentina's oil under development contracts with Y.P.F. have started producing crude in a steady and growing stream in the few months since drilling started. The level has now passed 5,400 bbl. daily.

TREND OVER THE LAST YEAR

	Western Hemisphere, less U. S.	Middle East	Total free-world outside U. S.
1958			
July	3,766.3	4,247.9	8,850.9
August	3,828.4	4,334.0	8,971.5
September	3,769.8	4,535.2	9,120.8
October	3,891.3	4,482.3	9,177.5
November	4,037.8	4,472.1	9,309.5
December	4,119.9	4,446.2	9,371.4
1959			
January	4,311.6	4,369.3	9,449.5
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,905.6	4,531.6	9,282.9

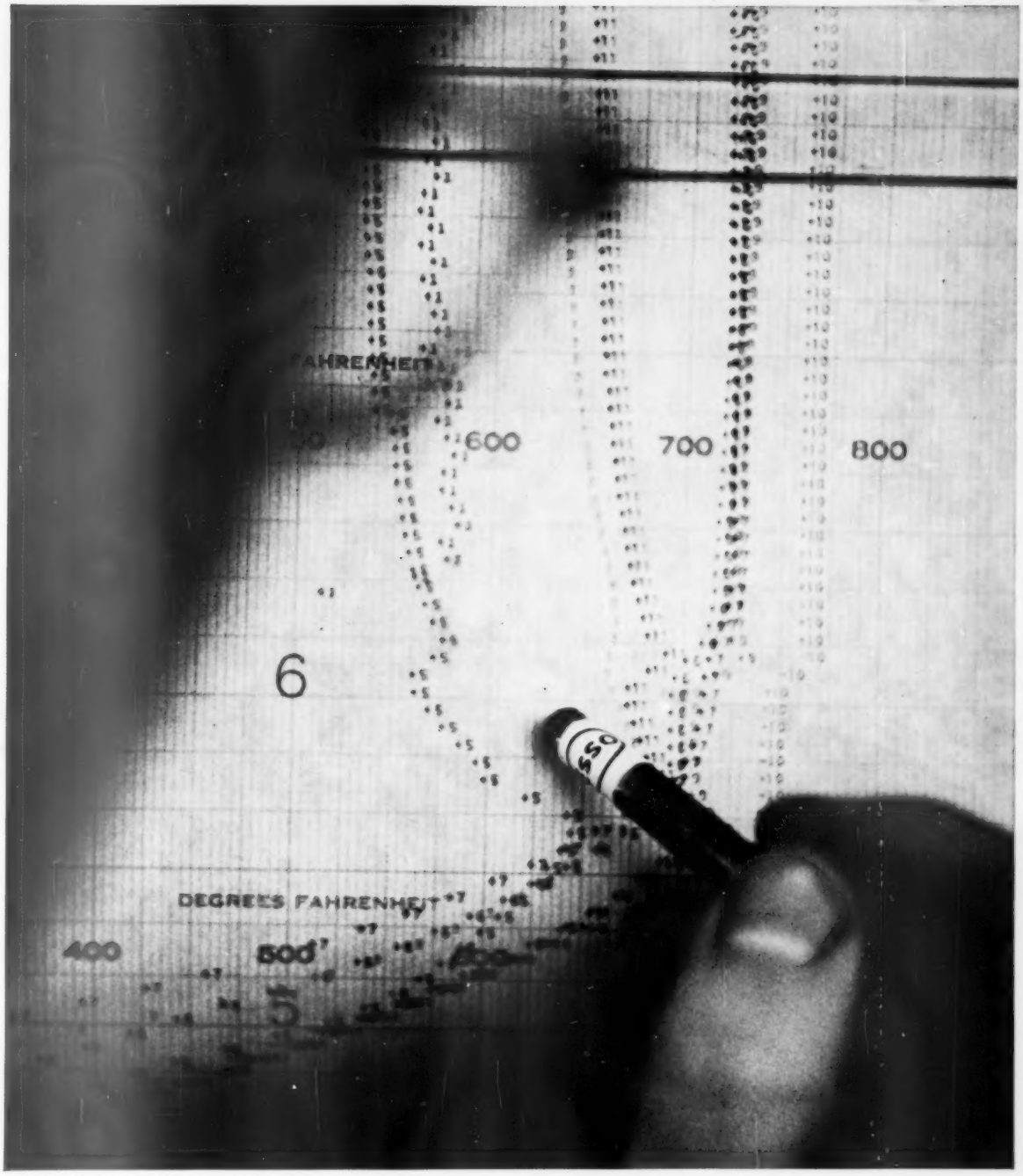
World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	July 1959	June 1959	July 1958
Western Hemisphere			
Argentina	119.5	119.3	90.1
Bolivia	8.9	8.9	9.2
Brazil	68.9	68.9	53.4
Canada	473.5	490.0	473.7
Chile	17.1	17.1	15.3
Colombia	147.8	147.3	124.0
Cuba	0.5	0.5	0.9
Ecuador	7.7	7.7	8.7
Mexico	268.1	268.1	253.1
Peru	48.5	48.6	54.4
Trinidad	112.4	112.8	102.5
Venezuela	2,632.7	2,822.3	2,581.0
Total	3,905.6	4,111.5	3,766.3
Europe			
Austria	45.5	45.5	52.8
France	33.6	32.1	27.7
West Germany	100.6	100.7	87.0
Italy	32.4	31.6	31.5
Netherlands	33.5	33.7	29.2
United Kingdom	1.7	1.7	1.4
Yugoslavia	9.7	11.5	9.8
Total	257.0	256.8	239.4
Middle East			
Bahrain	45.0	45.2	40.7
Iran*	906.0	949.0	798.0
Iraq†	827.3	823.3	755.3
Israel	2.0	2.0	1.9
Kuwait	1,394.8	1,268.1	1,353.5
Neutral Zone	120.0	120.0	68.5
Qatar	167.3	169.0	177.0
Saudi Arabia	1,062.7	1,084.8	1,046.2
Turkey	6.5	6.5	6.8
Total	4,531.6	4,467.9	4,247.9

Country—	July 1959	June 1959	July 1958
Other Asia			
British Borneo	107.0	107.0	106.0
Burma	10.5	10.5	10.0
India	8.5	8.5	8.5
Indonesia	345.0	345.0	358.8
Japan	7.4	7.6	7:1
New Guinea	4.4	4.3	5.5
Pakistan	5.9	5.9	6.0
Total	488.7	488.8	501.9
Africa			
Algeria	18.8	17.9	11.2
Angola	2.0	2.0	1.6
Egypt	53.4	58.4	65.2
Gabon	15.0	14.6	9.3
Morocco	1.8	1.8	1.5
Nigeria	9.0	9.0	6.6
Total	100.0	103.7	95.4
Free World			
Foreign	9,282.9	9,428.7	8,850.9
United States	6,784.0	7,083.0	6,571.0
Total	16,066.9	16,511.7	15,421.9
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	227.0
Russia	2,490.0	2,490.0	2,260.0
Others	60.0	60.0	60.0
Total	2,785.0	2,785.0	2,547.0
WORLD TOTAL	**18,851.9**	**19,296.7**	**17,968.9**

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 3,000 bbl. daily from Naft Khaneh field, operated by Iraq Government.

Figures are obtained from reliable industry reports or government sources. Estimates are made where complete reports are lacking.



"... It is not enough for a company to put out good products at a fair price. To compete successfully, it must demonstrate ability to keep up with and contribute to the technological revolution. This means new techniques, new processes, new products to capture the imagination and the dollars of the buying public."

— M. J. Rathbone, President

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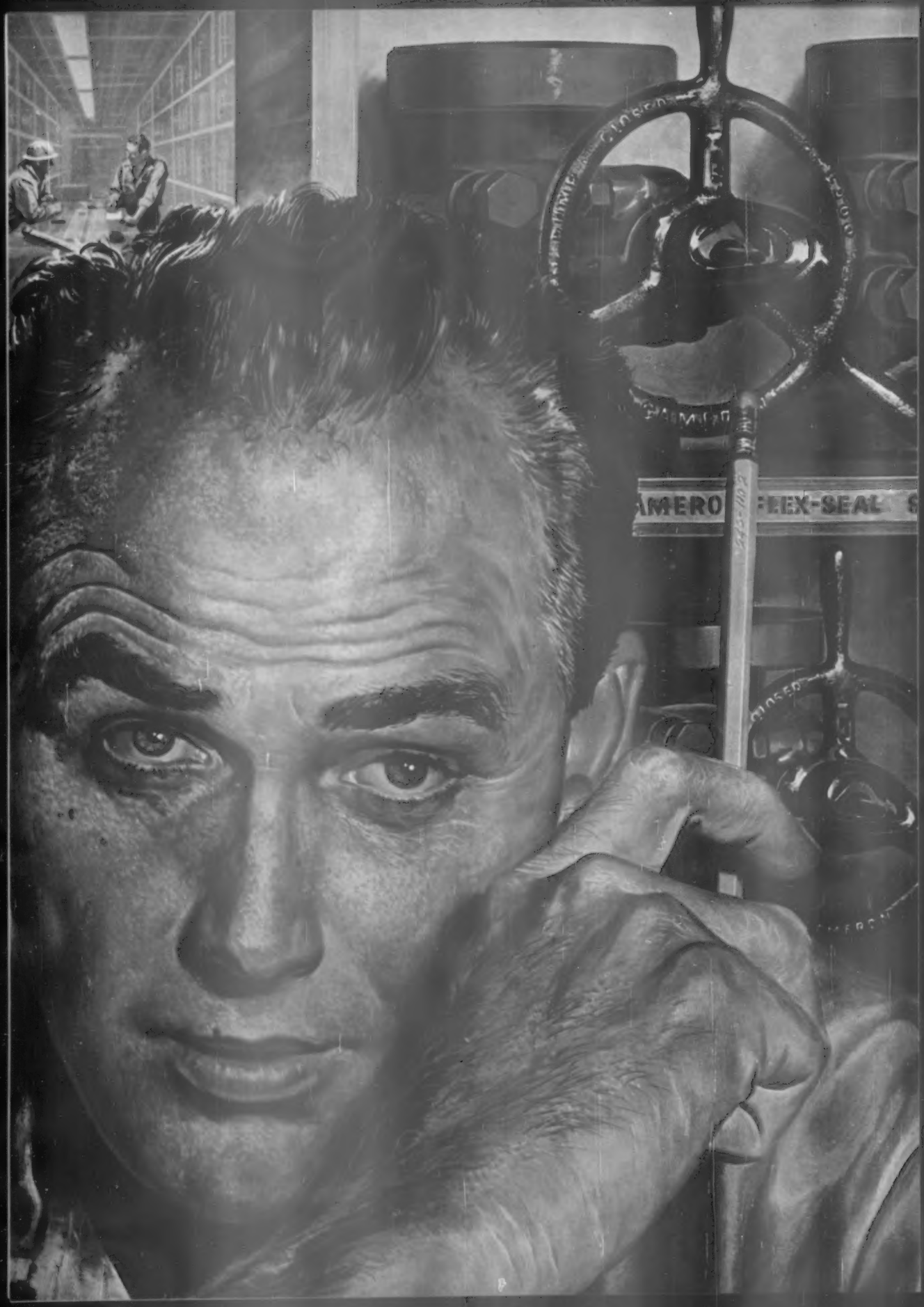
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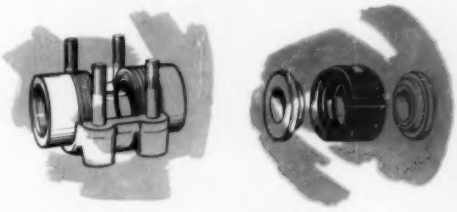
The reason for this remarkable record is Cameron's exclusive design – a basic design which was an immediate success with drillers all over the world. The Cameron Flex-Seal was designed to control the cutting action of abrasive-laden fluid under high pulsating pressure. Over twenty years after its introduction the Flex-Seal is still the favorite of smart operators everywhere – the valve most often asked for in supply stores. Rugged dependability, extra long service, and easy repair spell performance that can't be beat.

Extended cap nuts protect the all important stud threads from abrasion and corrosion, make bonnet removal extra easy in any position. Gate and stem are one solid forging, give perfect alignment with no wobble to increase wear. The only mud valve gate with a shoulder – affords energizing of packer. Rubber cannot flow past on tight closures.



Integral welded subs and body cap make misalignment during repairs impossible. If a sub is damaged it may be separated and replaced rather than replacing an expensive body unit. Tough compound in the big gate packer means lots more wear, easier repairs. Replacements require no special instructions or fixtures – no intricate positioning of gate stem threads. The oversize carburized steel wear rings are sealed against the subs by "O" rings and are removed straight out with the gate packer as a unit.

Flex-Seals are manufactured in the United States, England, and France. They are available in supply stores throughout the world.

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OIL AND GAS JOURNAL

A SPECIAL REPORT ON

REFINERY INSTRUMENTATION AND CONTROL

- Continuous-stream monitoring
- Analog computers in control
- Digital computers in control

FASTER and more accurate measurements, direct measurement of product properties and subsequent development of process-stream monitors, use of small analog computers to optimize control loops, and the first applications of computer control for a complete process unit—these are the developments going on now in refinery instrumentation and control.

Most activity is in the field of better and faster measurement of product properties, and transmission of that measurement to an operator who can use it in "real time" to control a process. This is necessarily so, because computer control depends directly on practically instantaneous indication of a given product property. The activity in this field is paying off in the development of vastly improved indicating and control instruments.

Another requisite for computer control is a knowledge of process dynamics. Where these are known, and where sophisticated measuring instruments are available, a few computer-control applications are being made. First large-scale activity will be application of analog units to component parts of processes. Wide utilization of digital units will come later after detailed process studies and searching economic evaluations.

1. What's new in continuous-stream monitors

EDITED BY GERALD L. FARRAR
Engineering Editor

GREAT PROGRESS has been made in the development of continuous-stream monitors during the past few years. And development of intsruments for direct measurement of properties has been particularly rapid. This trend is having a profound effect on instrument and control.

Traditionally, control of refining processes has been based on holding variables such as temperature, pressure, flow, and liquid level within predetermined limits. The theory is that product specifications should be acceptable if these variables are controlled carefully. Laboratory analyses, available within several hours after the sampling, provide the proof of the pudding.

Lately, however, control people have questioned whether this waiting time was actually necessary. And efforts have been redoubled for the development of continuous monitors for critical product properties. Ultimate aim is to use these monitors in the control loop to reset control points on standard controllers. Some of them are already being used in this manner. For the most part, however, the operator is adjusting the operating conditions himself, based on monitor results.

This section is devoted to the newer instruments for direct monitoring of product quality on a continuous basis. It contains a progress report on Sun Oil Co.'s Marcus Hook control center, case histories and brief accounts of the operation of some of the monitors, and some of the later developments in chromatography.

THIS BUILDING houses the equipment which Sun will use in its intensive study of refinery instrumentation and control.

Sun is moving ahead on its product-control center

BY PAUL D. BARTON
Sun Oil Co.

FOR MANY YEARS, the petroleum-refining industry has had the reputation of being one of the most highly automated branches of industry. This is largely due to the fact that most refining processes are continuous and instrumented for steady operation and careful attention to control limits for safety reasons. It has been the practice to allow considerable freedom of action to line operators and supervisors in the exercise of judgment in adjusting controls for major variations in flow rates and charge material characteristics, in addition to the need for appropriate action in all types of emergencies.

It is obvious that an individual operator's judgment reflects not only his personal experience but also his understanding of the processes involved and his interpretation of plant conditions and product test results.

Through the use of a mobile laboratory, we have observed important variations in a plant's operation directly caused by differences in operators' judgment-based actions in resetting controls. Thus, plant upsets, even though minor but of a magnitude easily detected by our laboratory recorders, have been shown to occur regularly after a change of shifts. These upsets are no doubt costly in yields, throughput, catalyst life, fuel, and maintenance, although it is impossible to place a value on them.

With the progress of refining technology, the design of larger and more complex units has been the rule over the past two decades until the modern refinery may be so integrated that all major operations are controlled from a central point with graphic panels, data loggers, and even computer equipment for operator guidance and control coordination. Also, closed-loop computer control presently is being applied in special cases by a number of refiners.

Basis of control . . . The effectiveness of process control, whether by operator judgment-based adjustments or by the more sophisticated computer-based coordinated adjustments, is closely related to the validity of the information available. In the past, much of the information used in control setting has been inferential in its nature: temperatures and pressures **indicate** certain basic quality values by correlation with composition and other characteristics. By such inference, continuity in process control is approached using criteria obtained by more or less frequent sampling and laboratory inspection of streams.

With the specific purpose of improving the quality of the information on which our plant operations are based, in December 1958, Sun's management authorized a project to construct and equip a Product Control Center at a 60,000-bbl. per stream day combination unit at the Marcus Hook refinery.

By July 1959, a three-room air-conditioned building had been completed in the heart of the plant operating area and the installation of stream analyzers and recording instruments was progressing rapidly. This building is functionally divided into a computer and data-processing room, a recorder room, and a calibration laboratory. The main control room of the 60,000-bbl. combination unit is located a short distance from the control-center building and most of the plant operating conditions can be monitored from this location.

Trial-and-error approach . . . Initial efforts of this project will be to locate

TABLE 1—12-3 CONTROL CENTER STREAM ANALYZERS

Unit and Stream	Automatic Inspection Property	Stream Analyzers	Stream Destination
Crude Distillation			
Atmospheric tower:			
Gasoline	50% point	Sun distillaiton analyzer	Offsite
Naphtha	End point	Totco end-point recorder	Offsite
Furnace-oil dist.	10% point	Hallikainen 10% boiling-point recorder	Offsite
Furnace-oil dist.	End point	Precision end-point recorder	Offsite
Gas oil	% dist. at 440° F.	Sun Hempel analyzer	Houdriflow
Reduced crude	% dist. at 440° F.	Sun Hempel analyzer	Intermediate flash
Intermediate flash separation:			
Separator overhead	Color	Sun color alarm	Houdriflow
Vacuum tower:			
Heavy gas oil	Color	Sun colorimeter	Offsite
Vacuum tar	Viscosity	Hallikainen continuous recording viscometer	Houdriflow
Viscosity Breaking			
Gasoline	End point	Hallikainen end-boiling-point recroder	Offsite
Cutback tar	Viscosity	Hallikainen continuous recording viscometer	Offsite
Houdriflow Cracking			
Cat. gasoline	90% point	Sun distillation analyzer	Light-ends processing
No. 1 cat. gas oil	End point	Precision end-point recorder	Offsite
No. 2 cat. gas oil	End point	Precision end-point recorder	Offsite
Wet gas to absorber	GLP chromatography	Sun chromatograph	Light-ends processing
Light Ends Processing			
Stabilized gasoline	Vapor pressure	Hallikainen continuous v.p. recorder	Offsite
Light stable gasoline	GLP chromatography	Sun chromatograph	Offsite
Butane tower bottoms	Vapor pressure	Hallikainen continuous v.p. recorder	Offsite
Butane tower overhead	GLP chromatography	Sun chromatograph	Offsite
Propane tower bottoms	Vapor pressure	Hallikainen continuous v.p. recorder	Butane tower
Dry gas from absorber	GLP chromatography	Sun chromatograph	Offsite
Desulfurizer			
Treated furnace oil	Sulfur analysis	Tracerlab, Inc. sulfur analyzer	Offsite

the pertinent plant conditions which influence the quality of individual plant streams. The method will be by trial and error, in contrast to the mathematical model and analog-computer-simulation approach. It was chosen because of the very complex situation existing in this particular plant. This complexity is due to the physical arrangement of the plant units and the fact that they are operated as separate units but with a coordinated operating plan.

This situation is the result of a series of modernization, expansion, and replacement projects over a number of years. The plant consists of two-stage crude distillation, Houdriflow catalytic cracking, visbreaking, gas recovery and stabilization, Girbotol gas purification, sulfur recovery, and, under construction, furnace-oil desulfurization.

The trial-and-error method was also selected because it was realized that unsteady operation in one of the plant units, for any reason, would be reflected in the stream characteristics from other units operating in series. The identification of cause and effect is of extreme importance in locating the control parameters which affect stream quality and product yield.

In general, our interest in the qualities of the various plant streams is centered in ultimate high yields of the more valuable products; however, some plant streams lose their identity in reprocessing within the area. An example is a heavy-vacuum gas oil which is vaporized and catalytically cracked.

Table 1 lists the various streams with the type of information which will be monitored. Wherever possible, this information is being obtained in the same form that is used currently by the operating and technical supervision in controlling the various plant units. This information is now obtained by laboratory inspection of more or less representative samples often taken only once per shift.

Initial operation. . . Initial phase of the control center operation will be concerned chiefly with data collecting and its correlation. During this phase of the study, a number of multipoint strip-chart recorders will be used. By this means, a precise time correlation is possible and related plant conditions can be collected on a single chart for a study of trends and reactions.

Processing of the data collected will be done jointly by engineers from Sun and Genesys Corp. Reason for this joint study is the pooling of the experience in petroleum processing of Sun engineers on the one hand, with the specialized computational and data-processing experience of Genesys engineers on the other hand. Their purpose will be the development of a comprehensive control means for a complex system such as that in this particular plant. Also of importance in this joint study is the distinct possibility of developing specialized devices for economically linking computational equipment with the conventional control systems already existing in this plant.

Two interests . . . In addition to the use of the data in the joint venture with Genesys Corp., Sun has two special interests in the success of this project:

1. Our experience with stream analyzers in other applications has indicated that the information made available to operators is in itself of great value. We have found operators quick to recognize the advantage of continuity of product quality information, and they do not hesitate to take the initiative in modifying control settings in the interest of steady-state operation.

The resulting benefits can be identified with several factors of economic importance. Depending upon the process involved, these benefits can be improved yields, greater throughput, better fractionation, or lower energy consumption, or a combination of several of them. The information obtained from the various stream analyzers of this control center will be made available to the plant operators in guiding their control adjustments.

2. A study will be made to identify operating limitations built into the

PRECISION END-POINT RECORDERS located in the plant area monitor catalytic-gas-oil streams from two fractionating towers at Sun's Houdriflow unit. Plant Foreman Bernard C. Faulkner and Operator Harry R. Barlow inspect the instruments.

STREAM ANALYZERS from left are Precision e.p. recorder and Hallikainen 10%-point recorder, both monitoring furnace-oil streams, and Totco e.p. recorder checking a naphtha stream. Martin Luther, of Sun's applied physics lab, points out components to Faulkner.

physical plant equipment. Identification of these limitations is related to steady-state operation. Information expected from correlation of plant data obtained from this project will be invaluable to the engineering department. It will be used in redesign or replacement of plant elements to obtain a coordinated whole for effective processing of the crude charge with minimum reprocessing to obtain finished products of the yield and quality desired.

It is our intention to operate the control center with the personnel from the applied physics section of the advanced management and method division throughout the study-developmental period. Specific controls developed and applied will be located in the operating areas under the supervision of the operating personnel. In case the development should finally lead to a coordinated computer-based control system, the product control center will be turned over to the operating department as a plant facility.

Analyzers supply continuous e.p.-i.b.p. data

BY D. H. STORMONT
West Coast Editor

INITIAL BOILING POINTS and end points of many refined products are being continuously and accurately determined by analyzers introduced in the past year.

The signal furnished by the instrument can be fed into a controller if automatic tower control is desired. This step has not been taken so far, however. As now used, the analyzers' output is recorded and manual controls used to adjust the quality of the product.

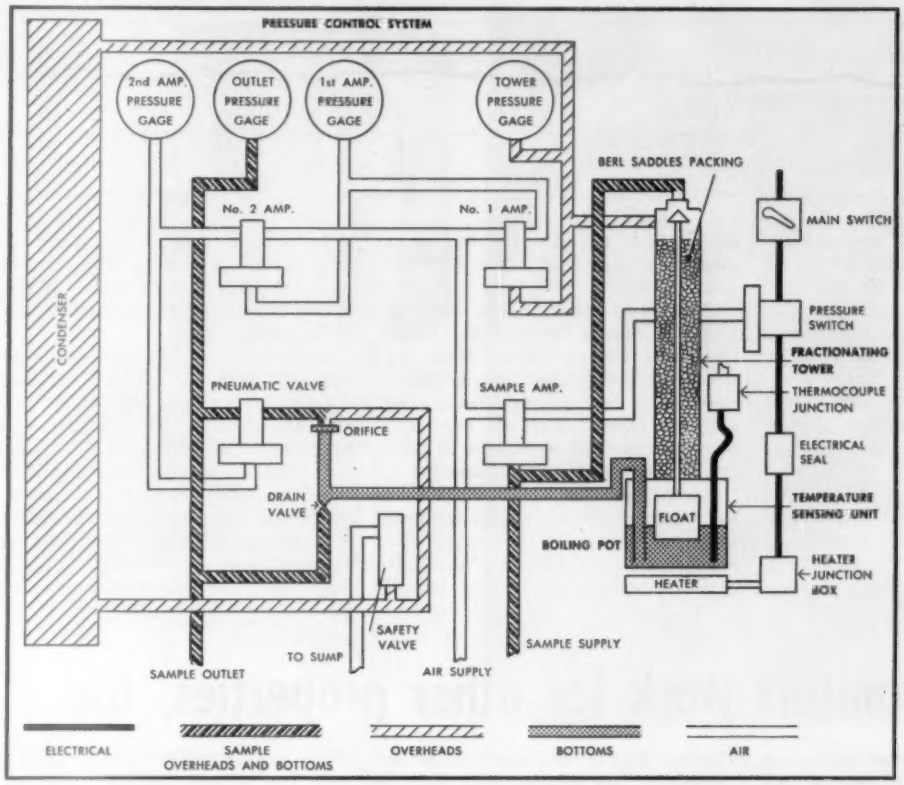
Advantages offered by the analyzers, which are installed at the operating unit and not in a laboratory, largely center around the time element. Operators know almost instantaneously when a product's end point or i.b.p. goes off specification. They don't have to wait for a sample to be taken to the lab and an Engler distillation run. Production of off-specification material thus is minimized and yields improved.

The analyzers also aid plant operations by permitting a tower's output to be regulated on a product-quality basis. There is no dependence on specific pressure and temperature conditions. Finally, their use also tends to lower control costs since the laboratory load is reduced.

How one analyzer works . . . After several years of development and testing, Technical Oil Tool Corp., Los Angeles, has introduced both end-point and initial-boiling-point analyzers. How the e.p. analyzer works is described in the following paragraphs:

A slip stream of the product is continuously passed through the analyzer at a 1 to 4-gal. per hour rate. Feed is through the top of a miniature distillation column which is packed with berl saddles. A float valve controls the feed rate to hold a constant liquid level in the boiling pot at the bottom of the column.

Electrical heat input to the boiling pot is held constant. Thus the amount of sample introduced varies in re-



SOLVENT operations have been improved greatly by this e.p. analyzer. The solvent is a petroleum fraction with 38° boiling range. Since installation of the analyzer more than 98% of the product has been up to standard, even when unit feed varies widely.

sponse to the fluid level in the pot. The amount of bottoms withdrawn is in direct ratio to the amount leaving overhead. A restriction orifice controls this ratio. By mechanically changing it, the analyzer can be set to indicate a point lower (such as the 90% point) than the end point.

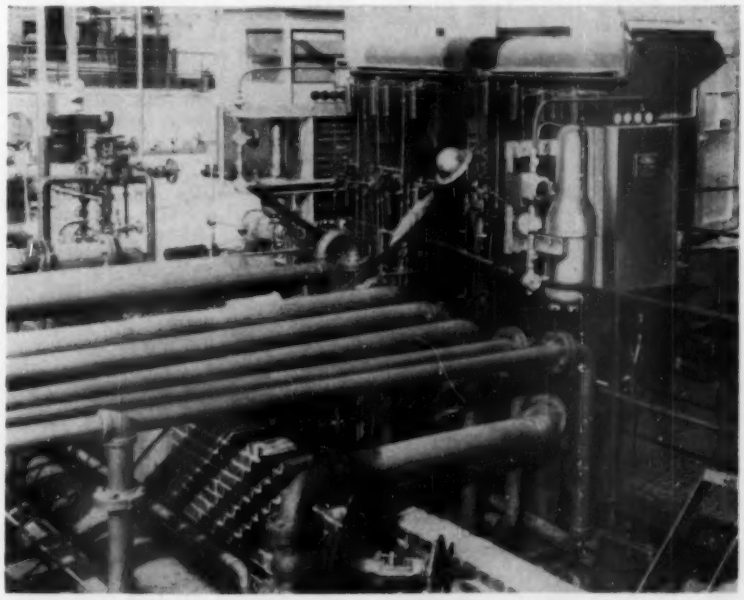
Constant tower and pot pressures are maintained by a two-stage pneumatic amplifier pressure-control system, by either opening or closing the control valve on the condensed overhead and bottoms line. Pressure variations of less than 0.1 psi. in the pot and tower are stepped up to 15 psi. in the pressure-control system.

The temperature-sensing element is located in the liquid-bottoms portion of the boiling pot. End points in the range of 200° to 600° F. are continuously indicated and transmitted.

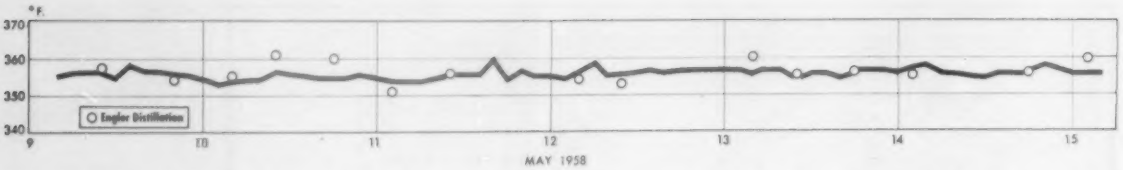
Should the product end point start to decrease, more of the sample vaporizes in the tower. This results in less sample reaching the boiling pot, which causes the float control to lower and permit more sample to enter the column. Since the heat input is constant, temperature of the fluid in the column and pot will fall until an equilibrium again is reached.

Operation of the i.b.p. analyzer is similar, except there is no distillation column. The sample is run directly to the boiling pot. Bulk of the sample is drawn from the analyzer as bottoms, with only the noncondensable ends being removed overhead. Operation of the pressure-control system is the same as in the e.p. analyzer.

... Excellent correlations have been obtained between analyzer recordings and laboratory Engler distillations. To check an e.p. analyzer's accuracy, a several-month test was made by one



TOTCO E.P. ANALYZER utilizes a small, carefully controlled distillation column. Equilibrium temperature in the column is the basis for e.p. determination.



E.P. ANALYZER RECORD checks closely with Engler distillation results, as shown on this plot of several days' operation.

company. The results of several Engler distillations daily were compared with the record plotted by the analyzer. As the accompanying plot shows, the variations between the two methods were well within the limits of human error.

Additional testing has shown that the analyzer's reproducibility is within ±1° F. throughout its operating range.

Case history . . . One West Coast company, which has been cooperating with Totco for several years in developing the analyzer, has both an i.b.p. and an e.p. analyzer installed on a cleaning-solvent unit in its Los Angeles refinery.

Product of the unit is a cut with a 38° F. range between the initial and final boiling points. The slip stream charged to the unit, however, can vary widely in composition. The desirable solvent fractions contained in the charge can be as little as 20% or as much as 45% of the charge.

As the operator of the unit has no knowledge of when a change has been made, or how much the change was, the product could be off specification for several hours when laboratory testing was the sole control. A surge tank was used to even out the variations in feed stock. Even then 4 or 5% of the solvent produced would be offgrade.

Since the plant has been operating under the guidance of e.p. and i.b.p. analyzers, more than 98% of the solvent has been up to standard. The surge tank is no longer used.

In addition to their resulting in a more uniform product, the instruments have reduced the number of laboratory tests made. Formerly some six determinations had to be made daily. Now, only nine per week are made.

Process monitors work for other properties, too

OTHER process monitors have been developed recently for refining and have been proved in operation. These include instruments for determining viscosity, vapor pressure, boiling point, flash point, color, and analysis for sulfur.

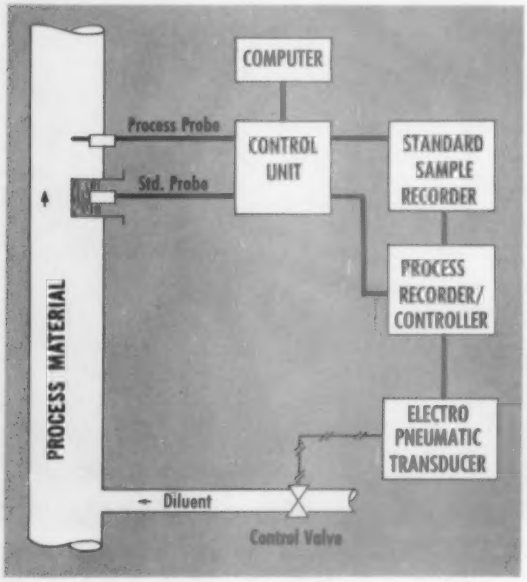
Monitoring and Control of Viscosity

The Bendix Aviation Corp. Viscomparator measures and controls viscosity directly and continuously by comparing the process fluid with a standard sample of the blended product which is inserted in a well in the process line. This is labeled "process probe" in the accompanying diagram.

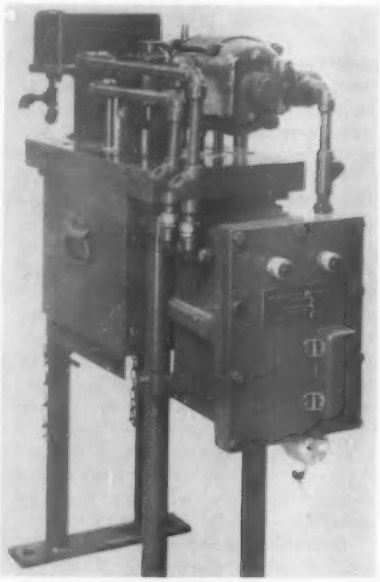
Since control action is based on standard sample viscosity, the blended product is caused to have the proper viscosity, independent of process temperature.

A circular-chart recorder-electric controller is used with the probe No. 1, sampling the process fluid. This is the master controller. A second circular-chart recorder serves as a follower, measuring the standard sample fluid.

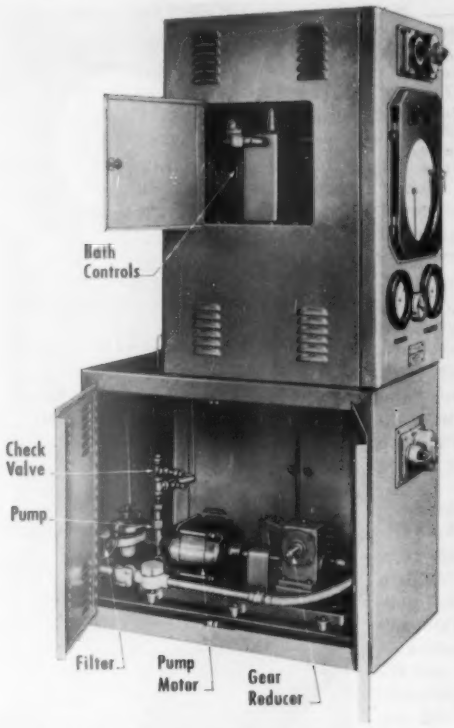
Under normal conditions the two recorders track each other up and down as the temperature of the process stream changes. If composition of



BENDIX Viscomparator measures and controls viscosity directly and continuously by comparing the process fluid with a standard sample. Control signal is generated by viscosity differences.



SHELL - HALLIKAINEN viscometer contains a capillary tube through which the process liquid is forced at constant velocity and constant temperature. Pressure drop across capillary is proportional to viscosity.

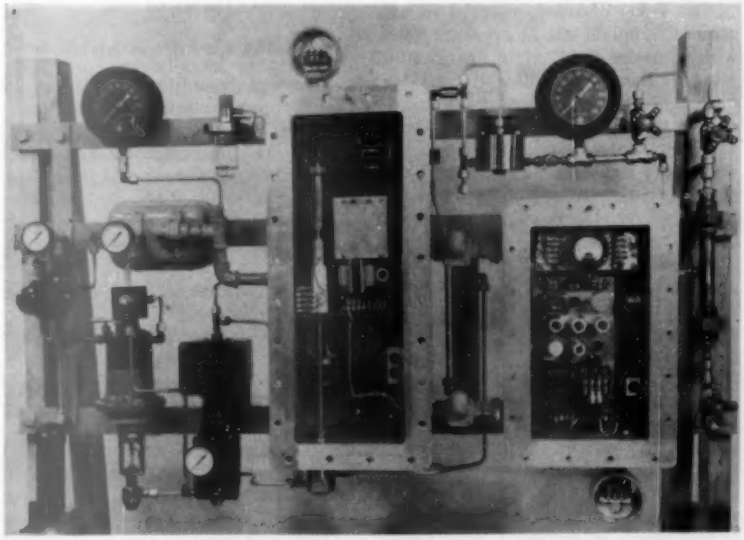


PRECISION VAPOR-PRESSURE MONITOR closely duplicates operating principles of the Reid-vapor-pressure test. Principle of operation is measurement of pressure of a sample in a constant-temperature vaporizing chamber.

HALLIKAINEN I.B.P. MONITOR depends on the refluxing of first vapors from sample. Only material at i.b.p. of sample touches recording thermocouple.

the process stream changes, control action is initiated to counteract the change.

The Shell-Hallikainen viscometer is used in a number of refineries to measure and control viscosities of fuel oils. The instrument was developed by Shell Development Co. and is marketed by Hallikainen Instrument Corp.



HALLIKAINEN VAPOR-PRESSURE RECORDER also works on principle of measuring the pressure of a saturated vapor in equilibrium with its liquid at constant temperature.

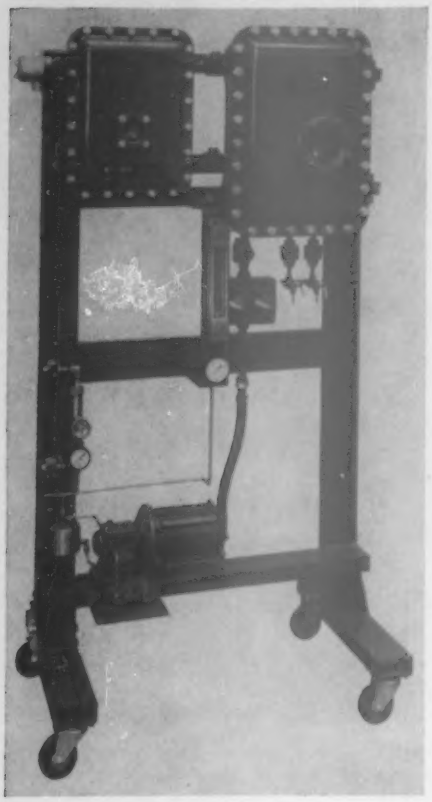
The instrument, shown in an accompanying photograph, contains a capillary tube, through which the process liquid is forced at constant velocity and constant temperature. The pressure across the capillary is converted to a pneumatic signal, which is a linear function of absolute viscosity.

Choice of capillary permits measurements to be made over a wide viscosity range. With the exception of changing the recorder chart, little attention or maintenance is required.

Continuous Monitoring of Vapor Pressure

Precision Scientific Co. makes a vapor-pressure analyzer which continuously monitors vapor pressure of a liquid and which closely duplicates the operating principles of the Reid vapor-pressure test. The instrument shown in the accompanying photograph takes a sample from the process line, filters it, and passes it to the inlet of a proportioning pump.

The sample then passes through a check valve into a constant-temperature bath. From here the sample goes to a vaporizing chamber where it exerts its vapor pressure at a constant



HALLIKAINEN E.P. INSTRUMENT operates with a constant sample flow. Flash evaporator removes 97% of sample. Residue drops off the tip of the evaporator, and its temperature is measured by a thermocouple.

PRECISION FLASH-POINT RECORDER automatically tests samples from a flowing stream at 3-minute intervals. Temperature of flowing sample is raised slowly until flash occurs.

temperature. Pressure is indicated directly.

The instrument has a pressure and temperature compensator, and measures pressure independent of atmospheric pressure and small temperature variations.

This analyzer is used at Magnolia Petroleum Co.'s Beaumont refinery to adjust the vapor pressure of gasoline with butane. Closer control of vapor pressure, reduced blending time, elimination of tank reworking, and upgrading of a significant amount of butane to motor gasoline have resulted.

The Shell-Hallikainen continuous vapor-pressure recorder also works on the principle of measuring the pressure of a saturated vapor in equilibrium with its liquid at a constant temperature.

Equilibrium conditions are maintained by controlling temperature of the sample and rate of flow. The sample enters the vaporizing chamber over a weir where the vapor-liquid volume relationship is held constant by controlling the flow of the sample as it leaves the chamber.

The instrument, shown in the accompanying photograph, features a sample flow-control system, a temperature-control system, a liquid-leveling-control system, and test circuits for ease in making adjustment during startup and for routine checks during operation.

Monitoring of Boiling Point

The Hallikainen-Shell i.b.p. recorder may be used for light hydrocarbons, with initial boiling points between 200° and 400° F. The measurement is a continuous process, and the recorder provides a permanent record of the i.b.p. of the material being produced.

Performance of the system, shown in an accompanying photograph, depends on the ability to control the boiling rate, the sample volume in the boiler, and the reflux rate. A small volume of sample enters the instrument continuously through a rotometer. Rate is maintained constant by a differential-pressure flow regulator.

The lightest-boiling material in the sample is boiled off at constant rate, with constant heat input being supplied by means of a 50-watt cartridge heater. Vapors rise, contact a thermocouple tip, are condensed, and return to boiler. Only material boiling at the i.b.p. of the sample contacts the thermocouple. Temperature as registered by the thermocouple is transmitted to a recorder.

Payout on an installation operating on the bottoms stream of a toluene column was less than 60 days.

End-point model . . . The Hallikainen-Shell e.p. instrument (see accompanying photograph), operates with a constant sample flow of 30 ml. per minute. The sample is introduced onto a falling-film flash evaporator, where about 97% is evaporated. Remaining residue drops off the tip of the evaporator where its temperature is measured by means of a thermocouple located therein.

This condition is maintained by controlling the heat to the evaporator by means of an electronic controller. Drop rate of the residue is maintained at about two per second. Operating range is 200° to 600° F.

Results fall within the requirements of ASTM D-86 test.

Automatic Flash-Point Monitoring

Precision Scientific Co. makes an explosionproof continuous flash-point recorder for use in refinery process control. The instrument takes samples from a flowing stream and tests them automatically at 3-minute intervals. The recording chart, which is not explosionproof, is mounted in the control room or at another nonhazardous point. The range on the instrument is 80° to 190° F.

In this device the product flows through the test cup continuously, with the test stream being slowly raised to the flash point by a preheater. After flash, the flowing product is cooled by a water-cooled heat exchanger. This also results in cooling the test chamber. The cooling period is 2 minutes.

The instrument is shown in an accompanying photograph. The recorder may be installed at a remote location.

Gas chromatography scores in stream analysis

THIS VERSATILE analytical tool has served its apprenticeship in the laboratory and is now being applied in the plant in many places as process-stream analyzer. Big advantages of the process chromatograph are wide applicability, simplicity, precision, and low cost.

The process unit costs around $5,000, complete with sampling system and recorder. The cost may be upped some if the process requires special modifications to the unit or if the sampling system is more complicated than usual. Whatever the cost, the criterion for installation seems to be 1 year or less.

Rapid payout . . . However, the chromatograph pays for itself in terms of weeks or months in many applications. Sunray Mid-Continent is saving $10,500 per month at its Snyder gasoline plant (OGJ, April 21, 1958, p. 119). The unit monitors product from a deethanizing absorber. In addition, upsets are less frequent, and operation is smoother. Yearly operating cost is about $500.

Savings of several thousand dollars per month have been accruing for Magnolia Petroleum Co. at its Beaumont refinery since the installation of a monitoring chromatograph (Refining Engineer, Feb. 1959, p. C-6). The unit enabled operators to stabilize compositions in the the operation of a deisobutanizer in an alkylation unit. The chromatograph also showed that improved temperature and pressure instrumentation were required.

A 4-month payout resulted when a process unit was installed on an ethylene unit (Petroleum Refiner, Dec. 1958, p. 115).

Automatic control . . . A few process chromatographs have been integrated into the control system, although most simply give the operator a fast, accurate analysis so that he can make the necessary adjustments.

Use of the unit in automatic control is complicated by the fact that the chromatograph is intermittent in its operation. Thus, the control system must wait from one peak to another for possible correction.

The simplest system for transmitting peak output to the control system is the peak picker and its related equipment. The peak picker senses the height of the peak selected for control and relays an appropriate signal to the controller. This signal will then change the set point of the controller as needed.

Phillips Petroleum Co. has recently developed a high-speed unit which gives one-component analysis in 60 seconds or less. Company engineers speeded up the unit by selecting and designing fast-acting components and by carefully matching instrument variables. The sampling valve obtains a sample of 0.05 ml., as compared to the usual sample of 1 ml.

The company is using the instrument to control a furfural extractive distillation column at its Borger, Tex., butadiene plant. The unit measures butene-l plus isobutylene and regulates steam flow to the column reboiler.

Many of the other recent advances in process chromatography are embodied in the following section.

. . . it monitors four refinery fractionating columns

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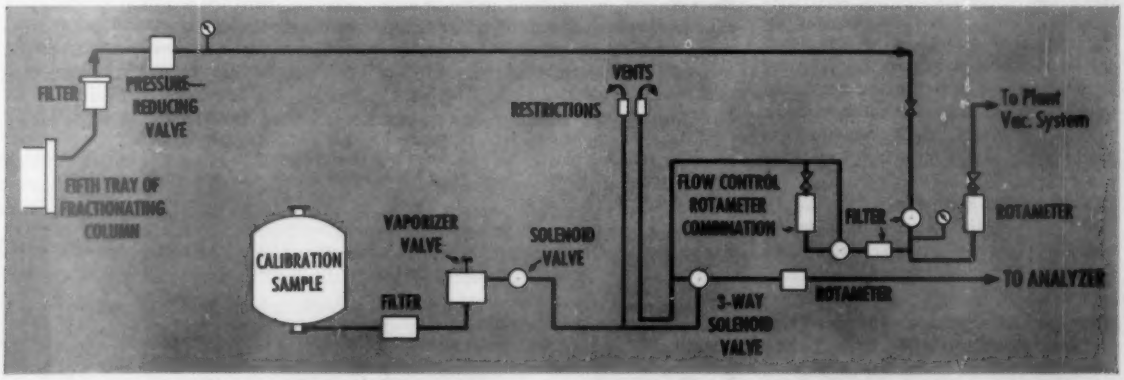
Manufacturing Department,
Humble Oil & Refining Co.

A PLANT-TYPE chromatographic analyzer has been "on stream" since late September 1958 at the Baytown refinery of Humble Oil & Refining Co. It is automatically analyzing in sequence samples from each of four plant towers which are in similar service. Further, by operating the appropriate switch a process operator can cause the instrument to analyze automatically and repetitively any one of the four plant samples or a standard sample, if it is desired to check calibration. The plant samples are being analyzed for isobutane and normal butane content at a rate of one analysis every 10 minutes.

The four fractionation towers are being used to split isobutane from alkylate and considerable difficulty was being experienced in controlling their operation prior to the installa-



SAMPLING SYSTEM for Humble chromatographic stream analyzer is set up so that a sample can be taken from any one of four distillation columns. Fig. 1.

tion of the chromatographic analyzer. The information made available by the analyzer has enabled the process operators to bring about much smoother operation of the towers and increase the recovery of isobutane appreciably.

The economic credit for this smoother operation, along with the savings from reducing laboratory tests to 4 per day from 24 per day, has paid for the $15,000 worth of hardware in the analyzer and sampling systems in about 90 days.

The control problem . . . The isobutane content of the alkylate bottoms fraction from each of the four columns is controlled at about 4 to 6%, but not by analysis of the bottoms. The bottoms contain a high percentage of material in the gasoline boiling range which does not lend itself to automatic analysis for iso and normal butane by any type of plant-stream analyzer.

Instead, a vapor sample is taken from one of the lower trays in each tower to minimize the amount of normal pentane and heavier materials in the sample to the chromatographic analyzer. The fifth tray was selected since vapor-liquid composition data showed that the amount of nC_5-and-heavier material in the vapor decreased sharply going up the column, leveling off at about 0.5% by volume in the vapor above the fifth tray.

Precutter . . . A unique feature of the analyzer enables it to handle the small amount of relatively heavy material in the sample quite easily in the 10-minute analytical cycle. The analyzer was modified for precutter-column operation so that it could handle the heavy material.

The heavier components (isopentane and higher boiling in this case) are retarded in the precutter column while the butanes enter the analytical column. Then, while the analysis of the butanes fraction is being completed the heavy components are backflushed in preparation for the next cycle. (Backflushing from the main column will give a record of the heavies as a single peak, but this procedure takes longer.)

Experience has shown 13 to 18 vol. % iC_4 in the vapor sample to the analyzer corresponds to the desired 4 to 6% iC_4 in the bottoms.

Sampling . . . Data on the analyzing section are shown in Table 1. The sampling system is shown in Fig. 1. Vapor samples, taken from the fifth trays of the deisobutanizing towers at 120 to 140 psig. and about 180° F., are passed through a 12-μ metallic filter and expanded to about 10 to 15 psig.

The pipe runs from the reducing valves to the analyzer house, which range from about 125 ft. to about 350 ft., have been steam-traced to prevent condensation of any of the small amounts of C_5+ material in the sample. The sample is passed through a second 12-μ metallic filter as it enters the analyzer house to assure a clean sample to the flow controlling-flow switching portion of the system.

The flow through this portion of the sampling system is maintained at about 10 to 15 cu. ft. per hour, giving a maximum holdup time of about 0.8 to 1.3 minutes for the system which contains the longest pipe runs. Since holdup time in the remainder of the system which carries the sample into the analyzer is only about 0.2 minutes, the maximum total holdup for the entire system is thus about 1.5 minutes.

The major portion of the stream is routed to the plant vacuum system, while a flow of about 150 cc. per minute flows through a small line filter to the flow-controller assembly. This system maintains a constant flow past the three-way solenoid valves to the vents. The solenoid valves are actuated by the instrument's programing system to route the vapor sample to the analyzer. The representation of the system in Fig. 1 has been simplified to show only the solenoids for introducing the standard sample and one of the process samples.

Location of the solenoid valve just downstream of the finned vaporizing needle valve in the calibration sample line is an important feature of the sampling system. Originally the solenoid had been located in the line between the small line filter and the vaporizing valve. However, it was found that heat from the operation of the solenoid in the open position was causing fractionation of the liquid sample which passed through it. This was causing variation in the composition of the standard sample reaching the analyzer.

Temperature and pressure checks . . . A temperature indicator is used to measure the temperature of the analyzing section. Operating temperature is 80° C. Back pressure on the chromatographic column is kept at 6 psig. during analysis. Measurement of column back pressure is a very effective means of indicating that the carrier gas rate is correct. Also, it gives immediate indication of leaks in the carrier-gas system within the analyzer section of the instrument.

A readily available indication of the temperature of the analyzing section has also been found to be most helpful in "trouble shooting" on chromatographic analysers. Temperature control has been excellent and has presented no problems.

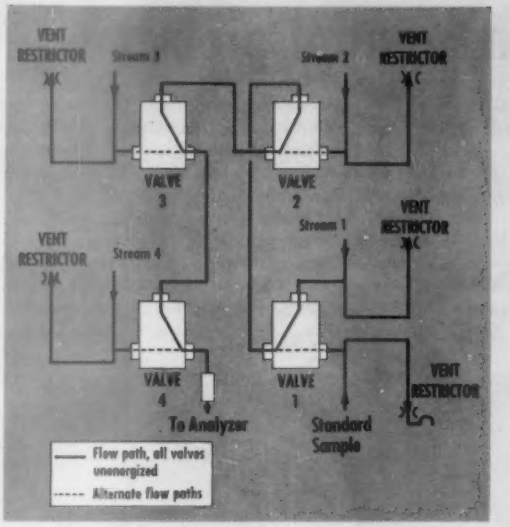
A continuous indication of the sample flow rate is provided by a small rotameter attached to the analyzer base. A second small rotameter provides a measurement of the flow of carrier gas used in back-flushing the precutter column. The exact volume of this flow is not important. However, it is important to have a positive indication that there is flow and that it remains around 30 to 40 cc. per minute. This minimizes helium consumption and assures adequate backflushing.

Valve manifold . . . Another interesting feature of this system is the solenoid-valve manifold, used to route the several streams to the instrument. As shown in Fig. 2, this assures fresh representative samples as a result of the flow of sample past the valve to the vents and by the self-flushing action in the manifold. Fig. 2 shows all four solenoids in the unenergized position which allows about half of the flow of Stream 1 to be routed to the analyzer, with the remainder flowing out the vent. The other streams are venting.

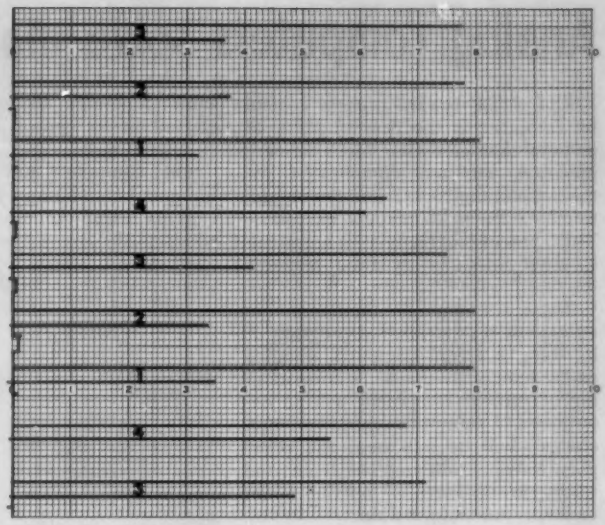
Since the pressure maintained in the sample lines by the restrictions in

TABLE 1—DATA ON ANALYZING SECTION

Precutter column:	5 ft. of ¼-in. stainless-steel tubing packed with 30% by weight of dinonyl phthalate on 30-60 mesh fire brick.
Analyzing column:	9 ft. of ¼-in. stainless-steel tubing packed with 30% by weight of dinonyl phthalate on 30-60 mesh fire brick.
Carrier gas:	Helium.
Carrier gas flow rates:	(1) Approximately 40 cc./min. through precutter column. (2) Approximately 40 cc./min. through analyzing column.
Standard column back pressures:	(1) 10 psig. on precutter column plus analytical column. (2) 6 psig. on analytical column.
Standard operating temperature:	80° C.
Sample loop size:	1 cc.
Sample flow rate:	Approximately 50 cc./min., as a vapor.
Type of sample introduction valve:	10-port rotary.



SOLENOID-VALVE MANIFOLD is used to route the several streams to the instrument. Manifold has self-flushing action. Fig. 2.



RECORDER CHART shows bar-graph representation of the data and the numbered identification of each analysis or pair of bars or peaks. Fig. 3.

the vent lines is only very slightly above atmospheric, there is essentially no chance of one sample leaking into the flowing line while another is being routed to the analyzer section. Energizing any one of the valves will switch either the standard sample or Streams 2, 3, or 4, to the analyzer section. The operation of the valves is programed to allow ample time for the stream switched into the system to flush out the previous stream prior to introduction of a sample into the chromatographic columns.

Recording and programing . . . The recorder and the programing section are located in the fractionating unit's control house about 400 ft. from the analyzer section. These have been mounted in the instrument panel along with the conventional instruments. The programer section includes bridge power supply and associated circuitry, and the timers. This is all contained in a convenient pullout drawer which makes all components readily accessible for maintenance, the need for which has been at a minimum thus far.

A zero to 10-mv. recorder is used which includes some special features that adapt it very well to the application. It has been programed to present the data in bar-graph form under normal operating conditions and has been calibrated to record the amount of iC_4 and nC_4 present on a liquid volume per cent basis. The iC_4 is presented at a 0 to 50% full-scale sensitivity and the nC_4 at a 0 to 100% full-scale sensitivity.

There are two features which identify the stream being analyzed. Four small numbered lights are located in a small panel along the top face of the recorder. The one corresponding to the stream being analyzed lights while the recorder is presenting that analysis. After the chart has advanced several inches past an analysis, a chart printer contained in a plastic box on the face of the analyzer prints the number 1, 2, 3, or 4, as appropriate, beside the analysis record.

Fig. 3 is a schematic representation of a section of chart from the instrument. It gives a clear view of the bar-graph presentation of the data and the numbered identification of each analysis or pair of bars or peaks. The first peak in each set of two, reading up the chart, represents the iC_4 concentration, which on a 0 to 50% full scale basis was running between 16.0 and 30.5% by liquid volume in these analyses.

The second or longer peak in each set represents the nC_4 concentration, which on a 0 to 100% full scale basis was running between 64.3 and 80.5%. The cycle timer assures chart advancement even at zero concentration of either component.

Zero indication . . . This analyzer has in its system an excellent automatic bridge-zeroing mechanism which zeros the detector bridge circuit after each analysis. However, it is very helpful to know how much correction, if any, was necessary since this gives an immediate indication of the development of zero drift. The instrument was therefore programed to present bridge zero at maximum gain on the recorder chart between analyses. The small plateaus which follow Analyses 1, 2, and 3 in Fig. 3 are examples of zero presentation and represent a very insignificant drift of bridge zero.

The recorder circuitry includes an automatic battery balancing mechanism which also has functioned quite satisfactorily and thus far has not interfered with the presentation of the data. This balancing requires about 7 seconds and occurs about twice in 24 hours when the recorder is presenting the data in bar-graph form. If the chart were advancing continuously, as it would be if complete chromatograms were being presented, the battery balancing would take place once every 48 minutes. (A manually operated switch to make the instrument present the data in chromatogram form is included in the programer section.)

A convenient operating mode has been included in this analyzer to permit an instrument mechanic to check the synchronization of the cam settings with the elution time of the peaks. Operation of a switch located inside the programer drawer turns on the recorder chart-advance motor during bar-graph operation. This mode of operation will show on recorder chart whether entire peak is being included in the time between cam settings.

The recorder pen is of the ball-point variety. This prevents tearing of the chart when the pen remains in one position for a time.

This article is adapted from a paper presented at 1959 Texas A&M Instrumentation Symposium.

Analog computers solve many control problems

FIRST STEP toward process control by computer is the determination of process characteristics. Most refinery processes are too complicated for their optimum operation to be determined by mathematical equations. Thus, process characteristics are usually determined by dynamic response tests.

These tests can be carried out in an extensive experimental program or by using a digital computer installed on a temporary basis. Malfunctioning of process equipment will be determined, possible instrumentation changes will be indicated, and other plus values will accrue from the study, in addition to obtaining the basic process information.

There are some processes or parts of processes which are well enough understood without a special study of process characteristics. These processes are ready for the second step, which is the proper selection and installation of direct computer control. Precise fractionation is a case in point.

Computer control in a limited area such as a single process or a part of a process, may be termed local optimizing control. The analog computer is very well suited for this application because it is simple, rugged, accurate, and reliable. The analog can be tailored to the job at hand, and once the control job is defined, needless components are not built into the unit.

Humble installation . . . An analog computer is controlling a naphtha fractionation tower to capacity vapor rate in the Baytown, Tex., refinery of Humble Oil & Refining Co. The column is part of a desulfurization unit and charges a desulfurized light crude-naphtha stream. It is a 14-ft.-diameter, 50-plate unit which cuts hexanes-and-lighter overhead.

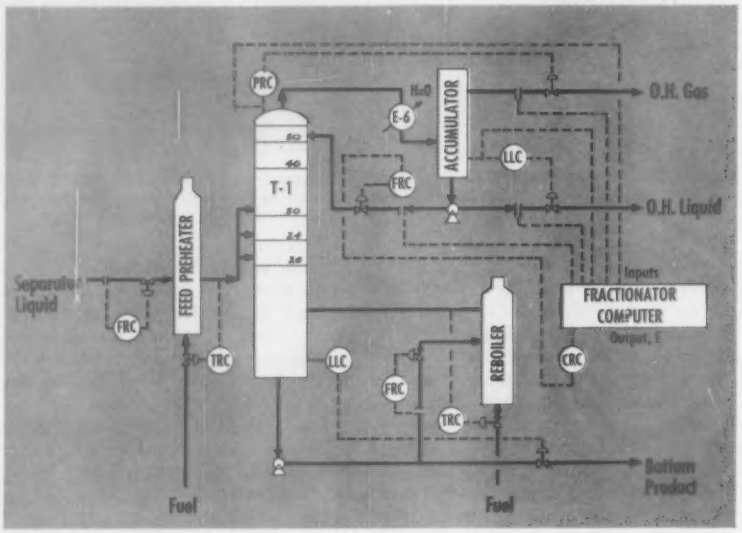
The computer determines the vapor capacity of the tower and the actual vapor rate inside the tower, and controls the reflux continuously in order to achieve this maximum.

The computer is a Southwestern Industrial Electronics CM-2 unit. It uses magnetic amplifiers, diodes, and transistors. There are no tubes or moving parts.

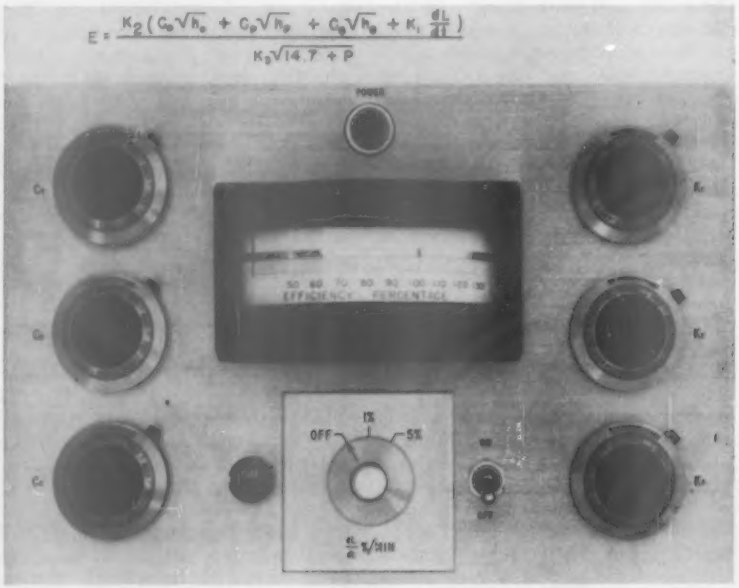
Step 1, or determination of process characteristics, in the Humble study was a capacity test on the tower. In this study it was found that the tower becomes limiting in the top section at a preheat temperature above 350° F. Thus, computer application was indicated to be control of vapor rate at its maximum value.

The computer uses a single entrainment equation to calculate vapor capacity. The equation contains an entrainment constant which is multiplied by the square root of the absolute pressure. This constant, which is adjustable, is determined by plant test. The actual vapor rate is determined by summing the overhead streams, reflux, distillate, and gas, and multiplying this sum by a constant to correct for enthalpy. This equation also includes the inventory in the accumulator as a constant times the rate of change of level.

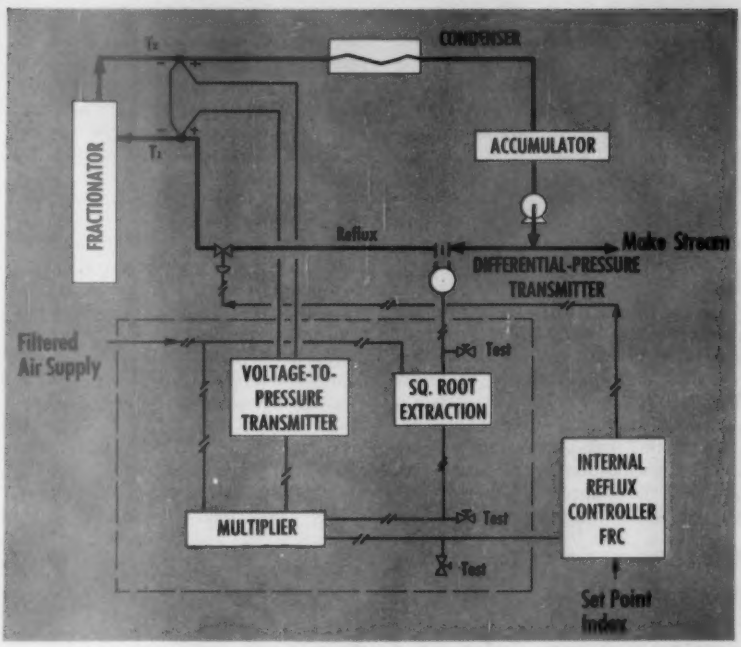
As shown in the accompanying flow scheme for the fractionating unit, the reflux rate-of-flow controller is cascaded from the computer. Con-



HUMBLE'S ANALOG COMPUTER on naphtha-fractionating column resets reflux rate-of-flow controller.



CONTROL PANEL for the Humble analog unit is laid out for direct setting of capacity vapor rate.



TEMPERATURE DIFFERENCE and rate of flow are combined in Phillips analog computer to give direct determination of column internal reflux.

trol panel for the computer is shown in an accompanying photograph.

Cost of the installation was less than $10,000, and yearly savings are conservatively estimated at $5,000. Other intangible benefits also accrue.

Another SIE CM-2 analog controller has been installed by Dow Chemical Co. at Freeport, Tex. The unit is being used for measuring the yield of a process, accepting inputs from analyzers which provide discontinuous outputs. This yield information will be eventually used for control.

Phillips reflux controller . . . A simple analog computer has been designed at Phillips Petroleum Co. to maintain internal reflux of a fractionator at a constant value. This is done by measuring the external reflux flow, measuring the differential between the tower-top temperature and the external-reflux temperature, and calculating the internal reflux flow. External reflux flow is than varied by the computer to keep internal reflux rate constant.

Need for this new computer is brought about by the difficulty of controlling external reflux temperature. This has been particularly troublesome where fan coolers are used for condensing fractionator overhead vapors, where temperature control is brought about by control of (1) fan speed, (2) variable-pitch fan, or (3) hot-vapor bypass. There is considerable lag in each of these systems.

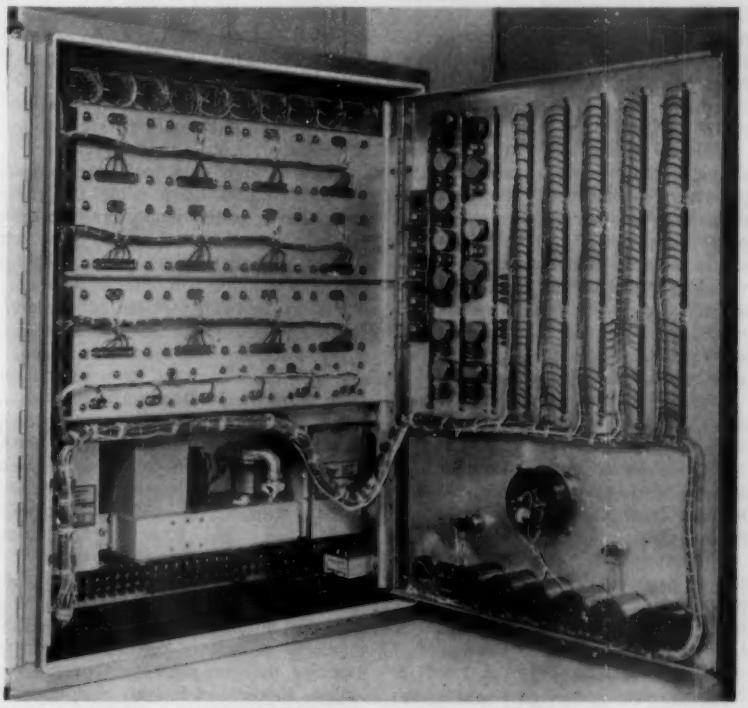
Advantages of the instrument are:

1. Less reboiler heat is required because there are no surges of internal reflux to lower column temperatures.
2. Production of off-specification materials is sharply reduced.
3. Closer control allows operation closer to flooding point, thus increasing capacity.
4. Condenser temperature controls can be eliminated, thus reducing equipment and maintenance costs.

The accompanying sketch shows schematic control diagram. The temperature difference, $T_2 - T_1$, is transmitted to the voltage-to-pressure transmitter. Here a pneumatic signal equal to $[1 + K(T_2 - T_1)]$ is generated and sent to the multiplier. (K is constant for a given fractionator application.) Also sent to the multiplier is a linear signal proportional to external reflux flow. This signal is produced by extracting the square root of the signal from the differential-pressure transmitter which is proportional to the square of the flow.

The multiplier combines its two input signals and produces an output signal (air pressure) which is proportional to the internal reflux flow. Internal-reflux controller receives this signal and holds it constant by varying external reflux flow.

The index of the internal-reflux controller can be set by cascade or ratio arrangements from other type controllers such as tower-feed controller, product analyzer, etc.



INTERNAL CONSTRUCTION of the Southwestern Industrial Electronics SIE Model CM-2 general-purpose analog computer.

Quick payout time for the unit is reported.

Sun program . . . The analog computer-controller will play an important part in the Sun Oil Co. Marcus Hook study (page 128, this section). The company will utilize small, transportable digital units experimentally as process controllers. Once proper control system and controller have been determined for an application, a permanent system will be designed and installed. The experimental computer will then be used elsewhere in the study.

One process unit in the Sun program is a 5,000-bbl. per day column separating normal and isobutane. This tower is equipped with process-stream monitors and other special devices. Temperatures and compositions can be measured on alternate plates up and down the length of the tower.

The tower will first be run under various conditions to determine its process characteristics. Next step will be the use of a Litton-80 digital differential analyzer for computer control.

Sun will also use a Westinghouse Opcon optimizing control computer in its study. This computer will manipulate process variables to determine conditions for most economic operation.

Dow Chemical Co. has been using an Opcon to control a pilot plant since mid-1958. The unit makes styrene by dehydrogenation of ethyl benzene.

Other analog units . . . An analog controller known as the Quarie Maximizer has been developed by Quarie Control'ers. This unit can maximize or minimize a process by operating upon the slope of a curve or the ratio of two variables.

The controller operates by disturbing a process parameter and analyzing the change in the process. As the result of the analysis of this change, the parameter is further adjusted. This process continues until optimum conditions are attained.

A complete optimizing fractionator control system with two units to adjust steam-to-input feed ratio and reflux rate costs $5,000 or less.

General purpose analog computers available are the Southwestern Industrial Electronics Co. SIE CM-2, a solid-state device using magnetic operational amplifiers; Electronic Associates, Inc. PACE TR-10, a small desktop unit with fully transistorized computing components; and Donner Scientific 3100, a medium-size unit.

3. Digital computers—key to tomorrow's pushbutton refinery

ONCE process characteristics are known and local optimizing control has been effected, the next logical step toward the completely automated refinery is the installation of digital-computer control for entire processing units.

This is a big step, even for the simplest refinery process unit, because the over-all relationships between individual processing steps must be completely established. The computer's job is to position the various primary variables based on the calculated secondary variables. Thus, the computer program must contain complete knowledge of how the primary variables affect the secondary variables.

Obtaining these interrelationships for complicated process units was once considered impossible, or next to it. However, much more is now known, and practical ways to determine other needed information are now in sight.

The computer itself can be used in this fashion. Computer determination of operating guides for operator use in control has been an accomplished fact at Esso Standard's Baton Rouge refinery since June 1958. A Leeds & Northrup analog-to-digital conversion system is linked to a Royal Precision LPG-30 digital computer which is installed in the cat-cracker control room.

About 160 primary measurements are made of temperatures, pressures, flows, etc. The computer uses these measurements to compute about 30 operating guides, which are actually relationships of primary to secondary variables.

Once enough data have been analyzed it should be possible for the computer to automatically position set points.

Work is being done to see whether processes can be computer controlled when process characteristics cannot be determined in detail. Mathematical relationships would be assumed, and the computer set to work controlling on the basis of these relationships. If the computer can be made to change these relationships to make the assumed process agree with the actual process, a big step toward process automation will have been made.

Instruments must measure up . . . Processes often contain large time lags, and control instability will result unless great care is exercised in programing the computer for corrective action. Better instruments and better design of instrumentation systems can cut down on this time lag.

Much work is going on along this line, as was shown in the earlier section on continuous process monitors. Even better monitors and a wider variety of them will have to be developed if fullest advantage is to be taken of computer control.

Computer-Control Installations

Texaco, Inc., has been operating a computer-controlled polymer unit at the Port Arthur, Tex., refinery since March 12. This is industry's first fully automated process. A Thompson-Ramo-Wooldridge RW-300 control digital computer in the control loop of the 1,800-bbl., $4,000,000 unit relieves the operators from all control functions except to observe how the computer is doing.

The poly plant handles about 15 million cubic feet of gas per day from thermal and catalytic cracking units. Feed gas averages about 30% propylene, but significant variations can occur. The poly plant has to be flexible enough to take these variations in stride, without significant change in reaction temperatures.

There are 10 cases, each with 3 beds of catalyst, used in the Port Arthur installation of the well-known UOP process.

The computer and other instrumen-

RW-300 CONTROL COMPUTER is a digital unit made by Thompson-Ramo-Wooldridge. Several installations are either planned, being installed, or operating.

tation were added to the unit during a shutdown when other work was done. Total cost of repairs and additions during the down period amounted to about $300,000. About $200,000 can be attributed to the addition of the computer.

The digital unit gathers information from 110 different sources in the plant. These include temperatures, pressures, and flow rates on 16 different streams. Olefin contents of three different streams are determined by process-stream chromatographs. Computations based on these measurements are used to determine appropriate settings for feed to the unit, recycle and water flow rate, reactor pressure, and catalyst-bed-outlet temperature.

The computer makes a decision on all this information and resets the plant control pattern every 5 minutes. It types a record of what it is doing, watches its own operation, and sounds an alarm if the system shows signs of outside-of-limit operation.

Texaco and Thompson-Ramo-Wooldridge spent 2½ years making a feasibility study of the installation and working out a mathematical model for the computer to follow in controlling the poly plant. **Expected results:**

- An increase of efficiency of 6 to 10%, to 93%, an extremely high figure for a poly unit of this design.
- Catalyst savings of $75,000 per year.

Texaco is not yet ready to release performance data on the installation. A company spokesman stated that the control setup is working well, indicating that the two objectives may have been reached or closely approached. The company may as yet be unable to determine how much of the efficiency increase is due to computer control and how much is due to the modernization program which accompanied the installation of the computer. This work included an additional poly train.

Other studies . . . Thompson-Ramo-Wooldridge and Standard of Ohio are jointly exploring the possible uses of computers for refinery closed-loop control. The RW-300 is the computer involved.

Esso Research & Engineering Co. installed a Royal McBee LPG-30 computer on a pilot plant at Linden, N. J., in 1958. Object was to control pilot-plant operations. Additional work remains to be done before the plant goes on 100% computer control.

B. F. Goodrich Chemical Co. has recently installed an RW-300 in closed-loop control at its Calvert City, Ky., plant. The $200,000 installation is controlling the processing in a vinyl chloride monomer plant. Monsanto Chemical Co. is expected to go on stream this fall with an RW-300 in closed-loop control. The company has not identified process or location.

Hardware

The accompanying table shows the characteristics of eight digital computers which are commercially avail-

able for closed-loop computing and control applications. Three others should be available soon for process control:

1. A system jointly developed by Leeds & Northrup Co. and Philco Corp.
2. Minneapolis - Honeywell D-290 computer.
3. Ferranti Electric ARGUS computer.

There are planned or operating installations of nearly all of the eight computer - controllers in the table. Most of these are outside the petroleum industry. Conceding that some of the systems may need a bit of debugging, it is evident that specifically designed computing equipment is now available, or soon will be, to do the control job.

What's ahead . . .

● Process control will be greatly improved in the next 2 or 3 years by the increasing application of process-stream monitors. They will be applied in most cases as indicators, to give the operator in "real time" the information he has had to wait hours to receive from the laboratory. Many good monitors are currently available, and work is being done on other needed instruments.

● Rapid payout in many instances will lead to the use of analog computers in the control loop in ever-increasing applications. These rugged, versatile units give trouble-free operation, provided process dynamics are known.

● Application of digital-control computers in closed-loop operation should be possible for all except the most complicated processes. However, an economic evaluation of the feasibility of such an installation is not easily made. Even after operating results are available, the decision is not too clear-cut.

Result is that installations will be relatively few in the next 2 or 3 years. However, 10 years should see many automated plants in refineries, and perhaps completely automated refineries.

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Digital Control Computers Now Available

Manufacturer	Thompson-Ramo-Wooldridge Prod., Inc. Los Angeles	General Elec. Co. Phoenix	G.P.E. Controls Chicago	Daystrom Systems La Jolla, Calif. Complete Daystrom Computer System	Panellit, Inc. Skokie, Ill.	Genesys Corp. Los Angeles	Autonetics Downey, Calif.	Bendix Corp. Los Angeles
Computer	RW-300	GE-312	Libratrol—500		Panellit 609	Unit Memory Processor	RECOMP II	G-15
Internal number base	Binary	Binary	Binary	Binary	Binary	Binary	Binary	Binary
Operating mode	Serial	Serial	Serial	Serial	Serial	Serial in G.P. mode Parallel in incremental	Serial	Serial
Bulk memory type	Drum	Drum	Drum	Magnetic Core	Magnetic Core	Magnetic Disk	Magnetic Disk	Drum
Bulk memory capacity								
Minimum	7,936	2,048	4,096	1,024	4,096	10,000	4,080	2,176
Maximum	7,936	16,384	4,096	16,384	4,096	30,000	4,080	2,176
Word length	17 bits + sign	20 bits + sign	30 bits + sign	20 bits + sign	38 bits + sign	19 bits + sign	39 bits + sign	28 bits + sign
Logic Active components	Diode	Transistor	Diode	Diode-Transistor	Core-Transistor	Hybrid logic	Diode gating	Diode
Cores (in logic)	None	None	None	None	800	157 to 350	None	None
Vacuum tubes	13	None	171	None	None	None	None	450
Transistors	approx. 580	approx. 1,600	approx. 250	approx. 1,800	2,400	212 to 280	1,137	None
Diodes	approx. 4,000	approx. 2,000	1,850	approx. 5,000	1,000	85 to 125	10,628	3,000
Time to perform sample calc.*	42 ms.	30 ms.	900 ms.	75 ms.	31.7 ms.	50 ms.	98 ms.	216 ms.
Weight	600 lb.	3,000 lb.	1,000 lb.	2,000 lb.	2 cabinets	200 lb.	197 lb. (computer only)	800 lb.
Size	36 x 56 x 29"	76 x 108 x 24"	30 x 42 x 60"	4 std. racks	66 x 56 x 16"	desk size	23 x 21 x 16.5"	60 x 27 x 32"
Power requirement	500W, 120V, 60 cy.	4KW, 120V, 60 cy.	1500W, 117V, 60 cy.	less than 2KW.	1 KVA.	350 watts	500W, 115V, 60 cy.	3.5 KW, 110V, 60 cy.
Price	$98,000 with basic input-output.	Varies depending on application.	$85,000 with A/D input & output logic.	$135,000 and up for complete sys.	$125,000 for complete control sys.	Varies depending on application.	$86,000 for computer only.	$49,500 for computer only.

*Includes addition, extracting square root, two multiplications, two comparisons, and transfer to and from storage.
This table was first presented at ISA petroleum conference, St. Louis, 1959, by Arthur Freilich (see list of references). It was updated and published in the July 1959, ISA Journal.

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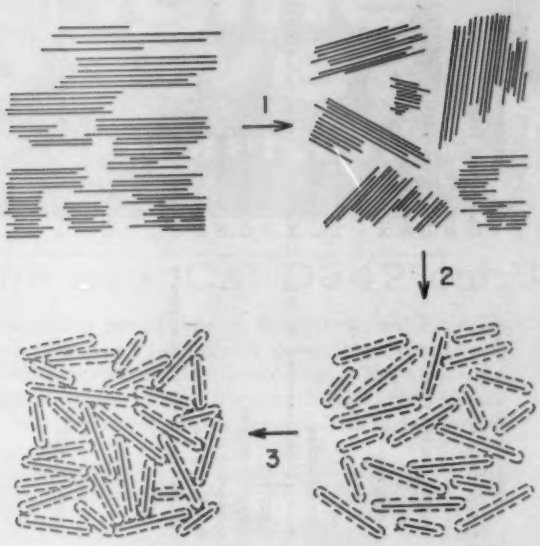
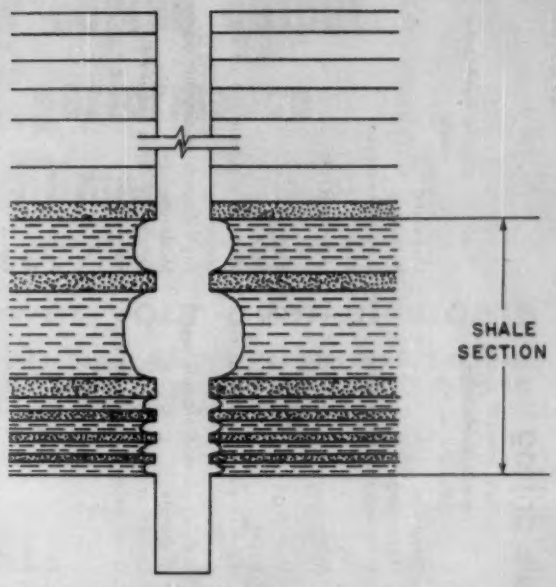


LIFE CYCLE of a mud-making shale. Compacted material is broken into large cuttings. Certain cuttings swell in presence of water and disperse into fine fundamental clay particles. Fig. 1.



HEAVING-SHALE CONDITION is the result of self-dispersion of shale. When undermining has reached a critical extent, the unsupported brittle shale and sands collapse. Fig. 2.

New drilling fluids harden shales

"The approach of the study reported here was that of developing an environment which would stabilize the troublesome shale and then developing a mud which would incorporate this environment"

By WALTER J. WEISS, WILBUR L. HALL, and RICHARD H. GRAVES
Exploration and Production Research Division, Texaco, Inc., Bellaire, Tex.

SHALE-CONTROL MUDS have been used to drill more than 1,000 wells covering almost every drilling condition in the United States and in many other areas.

These new drilling fluids have made savings in many ways. Some of these ways have been: reduction in use of barite, simplification of control, reduction of warehousing and logistic problems, and even reducing the amount of water consumed. Moreover, the new muds have made it possible in many cases to drill shale sections which probably couldn't have been drilled successfully otherwise.

The new shale-control drilling fluids stabilize the formation by chemical means. For this reason, preparing and maintaining them must be based primarily on chemical standards. A proper relation between alkalinity and calcium ion content results in a flocculated system. This flocculated system is controlled and stabilized by a floc-controlling or dispersing agent so that the mud is stable and relatively insensitive to contaminants.

Prepared shale-control reagent greatly simplifies maintenance of the new mud.

Paper presented at Fifth World Petroleum Congress, New York.

Longer sections open . . . In recent years, the depth of wells has increased rapidly. With this increasing depth, the resulting longer sections of exposed open formations have imposed a severe load on the drilling fluid.

In Fig. 1 we see the life cycle of a mud-making shale. Upon drilling, grinding action first breaks the compacted material shown in the upper left-hand corner into large chips or cuttings. As water attacks these cuttings, certain types swell and disperse into millions of microscopically fine fundamental clay particles which are intimately incorporated into the mud so as to increase viscosity severely.

These particles may further regroup themselves as shown in the lower left so as to gel the mud to such an extent that it can no longer be used as a drilling fluid without major correction.

In drilling normal, well-compacted, hard, black marine shales, the percentage of cuttings which disperse to fine clay particles, in the short time between cutting and arrival at surface screening devices, is small. Since additional mud volume is required as the well deepens, this limited shale dispersion causes little mud difficulty.

Also, if the clays are well compacted, there is no abnormal well-bore difficulty unless sections of this type of shale are highly fractured by formation movement or are under abnormal stress conditions.

Problem is self-dispersion . . . The main problems of well-bore stability are associated with shale bodies which

Table 1—Comparison of muds used in shale drilling

Feature—	Shale-control mud	Silicate mud	Simple low-pH muds, caustic-quebracho, phosphate, etc.	High-pH caustic quebracho muds
Type of system	Controlled floc	Flocculated	Dispersed	Dispersed
Shale reaction	Solidifying	Solidifying	Dispersing	Softening
Well-bore reaction	Stabilizing	Stabilizing	Sometimes deteriorating	Erosion sensitive
Mud-making properties	Very low	Very low	High	High
Original cost	Moderate	High	Low	Low-moderate
Maintenance cost for high-weight mud in shale drilling	Low	High	Very high	High
Conversion mud base	Hole	Compounded	Hole	Hole
Primary treating agents	Single powdered material	Mixture compounded at rig	Mixture compounded at rig	Mixture compounded at rig
Control procedures	Simple	Involved	Simple	Simple
Filtration-control mechanism	Organic agent	Uncontrolled	High dispersion-organic agent	High dispersion-organic agent
Filtration value maintained	Moderate	Uncontrolled	Moderate	Moderate-low
Emulsifying power	Excellent	Not used with oil	Emulsifier required	Emulsifier often required
Temperature resistance as normally used	Fair	Never fully evaluated—appears good	Good except phosphate mud	Fair
Contamination resistance:				
Salt	Excellent	Excellent	Poor	Fair
Calcium	Excellent	Undetermined	Poor	Fair
Logging characteristic	Good with calcium correction	Complicated	Good	Good

Feature—	Calcium muds*		Saturated salt muds*	Synthetic surfactant muds
	Low pH	High pH		
Type of system	Dispersed†	Dispersed	Flocculated	Controlled floc
Shale reaction	Softening	Softening	Softening	Softening
Well-bore reaction	Erosion sensitive	Erosion sensitive	Erosion sensitive	Erosion sensitive
Mud-making properties	High†	Moderate	Low	Moderate
Original cost	Moderate	Moderate	Moderate	High
Maintenance cost for high-weight mud in shale drilling	Moderate-high	Moderate-high	High	Moderate-high
Conversion mud base	Hole	Hole	Compounded	Compounded
Primary treating agents	Mixture compounded at rig	Mixture compounded at rig	Mixture compounded at rig	Mixture compounded at rig
Control procedures	Simple	Simple-involved	Simple	Involved
Filtration-control mechanism	High dispersion-organic agent†	High dispersion-organic agent	Organic agent	Organic agent
Filtration value maintained	Moderate	Moderate-low	Moderate	Moderate-low
Emulsifying power	Excellent	Emulsifier often required	Emulsifier required	Emulsifier required
Temperature resistance as normally used	Fair	Fair	Not fully evaluated—appears good	Excellent
Contamination resistance:				
Salt	Excellent	Good	Excellent	Excellent
Calcium	Excellent	Good	Fair-poor	Excellent-poor
Logging characteristic	Good with calcium correction	Good	Complicated	Calcium type needs calcium correction

*Exclusive of synthetic surfactant muds. †As normally practiced.

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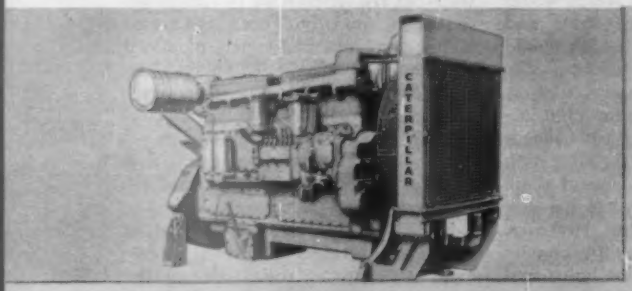
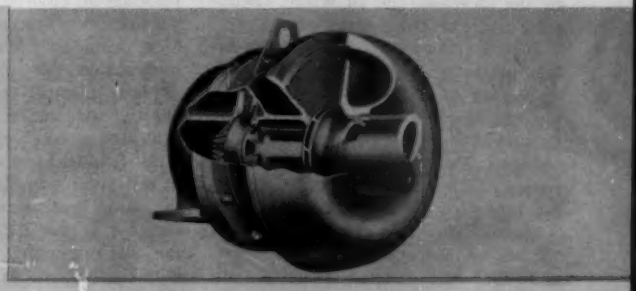


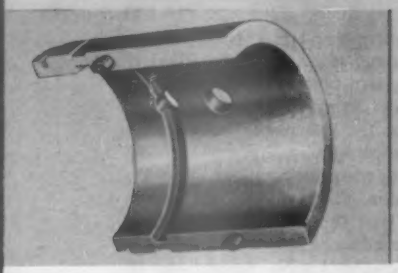
The turbocharged D342 develops 320 HP (maximum output) and 260 HP (intermittent), both at 1,300 rpm. For continuous duty it will produce 220 HP at 1,200 rpm. It measures 90 inches long, 44 inches wide and 60 inches high.



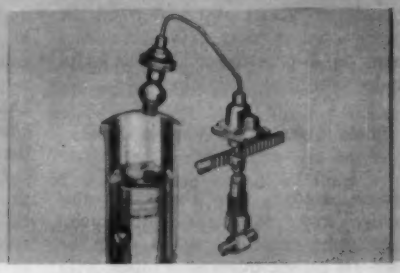
Turbocharging uses energy from the engine exhaust gases to pack more air into the cylinders. Fuel consumption per horsepower-hour is actually lowered and efficiency raised when this otherwise wasted exhaust energy is put to work.

These vital parts reduce down time, save you money

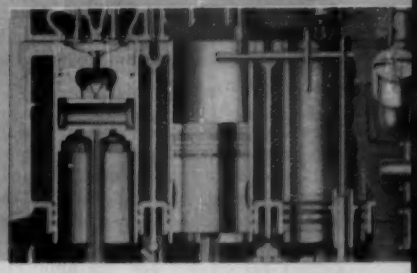
Steel-backed aluminum alloy bearings have great strength and durability. Their rapid heat dissipation means cooler running for very long life.



Fuel assembly, designed and built by Caterpillar, features individual fuel injection pumps and large, single orifice valves to prevent fouling, even when engines idle for long periods.



Full-length, wet-type cylinder liners are induction hardened. Liners are chemically treated to retain oil on liner walls. Pistons ride with minimum wear, heat is dissipated rapidly.



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". . . muds composed of calcium salts . . . will not increase shale stability."

undergo spontaneous self-dispersion upon contact with water or conventional drilling muds. These shales often escape detection during the drilling program since they cannot be identified on the electric logs and, in severe cases, no representative intact cuttings reach the surface of a sufficient size to be separated and observed on the shale-shaker screen.

If a close geological or engineering check is maintained on the mud, these shales can be suspected when the amount of cuttings recovered seems small for the amount of hole drilled. Or, it may be that the volume of new mud being formed is abnormally high per foot of hole drilled as reflected by the increased use of water, chemicals, and weighting materials.

Fig. 2 shows the deteriorating effect upon the well bore of this self-dispersion of shale. When undermining has reached a critical extent, the unsupported brittle shales and sands collapse. This accounts for the widespread field observation that "heaving shales" are hard, brittle shales.

From Fig. 2 it is apparent that the "heave" is a result and not a cause, and that the heaved material, although responsible for sticking tools, is not the primary problem.

It is obvious that heaving is also a structural problem for, in highly dipping formations, the allowable extent of undermining is severely reduced. It is impossible at this time to identify this type of shale by any of the current logging techniques, but its fundamental difference is readily apparent in a simple experiment wherein undried fragments of the two types of shale are dropped into ordinary tap water. The normal shale will be unaffected, while a critical shale will be dispersed into mud even without agitation.

How to approach problem . . . Any successful attack on the problems of well-bore stability must deal primarily with preventing self-dispersion of the shales. And many clays and shales were analyzed to learn the primary factors responsible for the abnormal reaction of these self-dispersing shales.

These studies were to relate the type of shale disintegration to well-bore instability, and established two distinct mechanisms in shale disintegration: (1) a physical change in shape and volume arising from swelling due to the imbibition of water, and (2) a spontaneous disintegration without an appreciable change in volume, which we have given the designation "self-dispersion."

It was noted that:

1. Most commercial drilling-mud bentonites, although having a high degree of swelling, are not normally self-dispersing and require mechanical agitation for dispersion.

2. Samples of severe heaving shales cored in Gulf Coast wells underwent spontaneous self-dispersion without appreciable swelling.

Some earlier attempts to drill heaving shale included high concentrations of electrolytes such as salt and high-pH caustic muds. Others sought to use strongly absorbed ions, calcium, and magnesium brines, to suppress swelling of the clays. The approach of the study reported here was developing an environment which would stabilize the troublesome shale and then developing a mud which would incorporate this environment.

Many electrolyte solutions such as caustic soda, salt, calcium chloride, saturated gypsum, and high-pH limed-mud filtrates suppress disintegration or self-dispersion. This occurs at about the same level of electrolyte content, i.e., 2-4 lb. per API barrel. However, the self-dispersing shales in contact with these solutions imbibe liquid and develop a degree of soft incompetence which makes them very sensitive to mechanical disintegration.

It is obvious that contact with any media which would result in the conversion of the sensitive shale to such an incompetent state would be entirely unsatisfactory. The hydraulic turbulence of the circulating drilling fluid would be sufficient to cause severe well-bore erosion and subsequent hole enlargement. This finding emphasized the danger of relying upon the simple visual observation of the dimensional stability of a shale fragment as a criterion of a successful shale-controlling medium.

Shale Control by Various Mud Systems

Simple muds . . . The clay-water muds, low-pH caustic-quebracho muds, phosphate-quebracho, and the high-pH caustic-quebracho muds, with the possible exception of the latter, were designed to obtain maximum dispersion and mud yield from the formation cuttings. Therefore, they should not be expected to control shale. Caustic-quebracho environment of the conventional high-pH red mud also does not solidify shale.

From this study, it was also apparent that muds composed of normal pH solutions of calcium salts, such as calcium chloride and calcium sulfate, will not increase shale stability.

Nonaqueous-base muds . . . Oil-base muds have been proposed for this application, but to our knowledge have not been used specifically for this purpose. The types of shale which present the major difficulty are normally high-water-content massive shales with a puttylike consistency which would tend to admix severely with an oil-base mud.

The degree of success in using such a fluid would be closely related to its ability to tolerate high water and solids contamination.

High-pH red-limed mud . . . High-pH red-limed mud has been the most highly developed and widely practiced procedure for shale drilling in the Gulf Coast area. Several misconceptions have evolved over the years concerning the chemistry of this mud. By far the most erroneous idea is that the clay solids in a red-limed mud are "converted to a calcium base."

Since the calcium-ion content is suppressed severely by massive treatment with caustic soda while at the same time the sodium level is being raised radically, the theories of base exchange predict that there should be no appreciable increase in calcium saturation on the clay.

To substantiate this prediction in an active mud system, a study was made to determine what change in the exchangeable bases on the mud solids occurs during conversion and maintenance of a high-pH limed mud. In 18 days, approximately 8,700 lb. of caustic soda, 26,000 lb. of lime, and 14,500 lb. of dispersant (10,500 lb. of quebracho plus 4,000 lb. of calcium lignosulfonate) were added to a mud system of approximately 1,200 bbl. They produced no significant change in the exchangeable bases on the clays present in the mud.

In line with theory, but contrary to common thinking, it can readily be seen that the high-pH limed-mud system produced little or no change in the relative Ca:Na saturations of the clays and shales despite the massive additions of chemicals. It was further found that self-dispersing shales soften and lose physical strength in contact with filtrates from such muds.

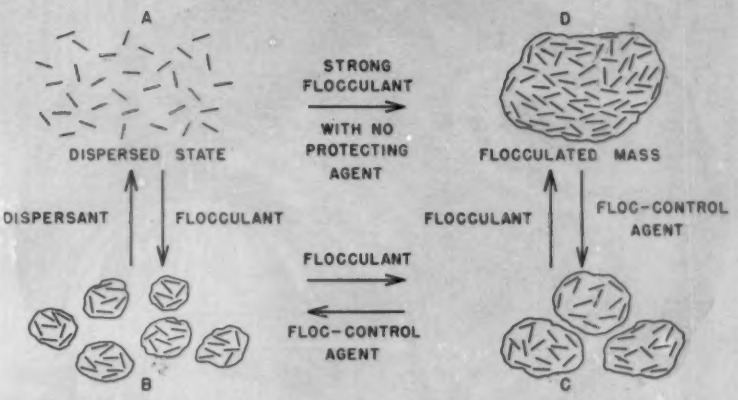
Therefore, the high-pH limed-mud system is not primarily a shale-stabilizing medium. Any shale effects appear to arise as a result of the concentration of electrolyte present in the filtrate phase of the mud and not as

"Shale-control muds must be controlled primarily by chemical analysis."

a result of actual reaction with such electrolytes.

Silicate muds . . . The only successful approach prior to this time in shale consolidation has been the silicate mud. Specimens of the soft incompetent self-dispersing shale in contact with the high-electrolyte, controlled sodium silicate environment develop a case hardening. This not only stabilizes the shale fragments but also imparts mechanical strength.

This hardening appears to have a limiting depth of penetration, for specimens so treated if later broken and placed in fresh water disperse on the newly fractured surface and leave a shell of the hardened shale as a residue.



INTERRELATED STATES of dispersion, flocculation, and controlled flocculation. Fig. 4.

Present Shale-Control Mud

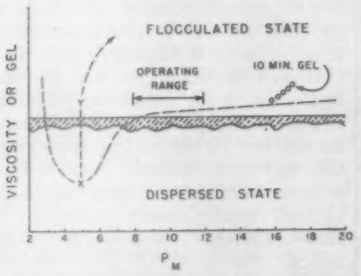
Studies of the chemistry involved in reactions with clay-containing materials led to the present shale-control mud. This system by coupling a high filtrate calcium level with a controlled alkalinity environment, develops shale stabilization by a process of progressive solidification. This is similar to that solidification previously only partially obtainable by use of silicate muds.

Samples of dispersing shale placed in contact with controlled-alkalinity, high-calcium mud filtrate undergo a progressive solidification. This, within reasonable time, renders them as hard and rigid in character as chips of highly compacted normal shale. The solidification obtained by use of this system differs from that obtained in the controlled silicate environment.

The solution with time penetrates the dispersing shale specimens completely and solidification is such that they will remain stable upon later extended exposure to fresh water even when mechanically broken into numerous small fragments.

A simple test showed the hardening action of the shale-control filtrate in comparison to that in simple electrolyte solutions with equal or greater calcium contents. In a fresh-water chamber, shale fragments underwent self-dispersion. This dispersion occurred in 16 hours without any change in dimension of the fragments (swelling) and without supplementary mechanical agitation.

Although retaining their original dimension, the specimens in the simple solutions developed no mechanical strength, whereas those in contact with shale-control filtrate underwent progressive solidification to a point where the mere tips of the specimens would support a load of over 1,100 g. with no indication of weakness.



EFFECT OF MUD ALKALINITY on gel or viscosity in the flocculated and dispersed states. Fig. 3.

Shale-control mud . . . Having established the shale-control environment, the problem was to incorporate this high-calcium, controlled-alkalinity environment into a fluid with satisfactory physical properties for use as a drilling mud. The mud had to be successfully maintained over long periods of time while drilling under a variety of conditions.

This can best be obtained by use of a fundamentally all-calcium salt system which is flocculated and restabilized or dispersed to yield a high degree of stability with simplified maintenance.

To formulate and maintain a properly balanced shale-control mud, shale-shaker reagents are available from mud-additive manufacturers.

Shale-control characteristics . . . Because shale-control muds are used for formation stabilization, they must be controlled primarily by chemical analysis of the mud and filtrate. This makes certain that the proper chemical relationships are being maintained to insure desired shale reactions. The physical properties are then adjusted, but only in a manner which will not be detrimental to shale stability.

It is important to emphasize the necessity for chemical control of this mud; it is possible for inexperienced personnel to miss the full advantage of the system if maintenance is based on physical properties alone.

Alkalinity-calcium relations . . . When a properly balanced shale-control reagent is used, the calcium-alkalinity relationships are established and the mud can be field controlled by maintenance of the mud alkalinity, P_m, with a nominal amount of engineering supervision.

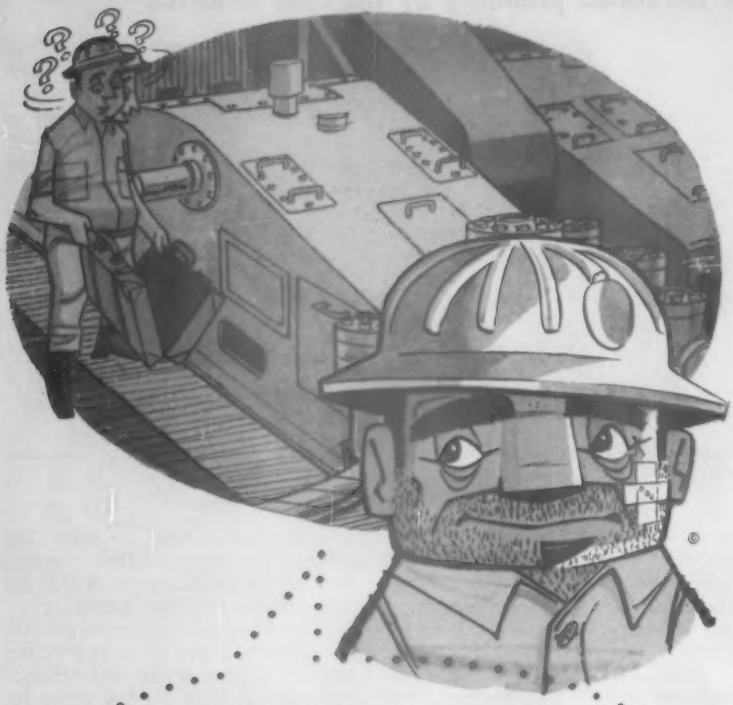
Control of the shale and the state of flocculation or dispersion of the mud is related to the alkalinity control of the whole mud. It is important that the controlled flocculation state be maintained to insure stable physical properties in the system.

Fig. 3 is an idealized representation of the complex relationships between viscosity or gel, and mud alkalinity, P_m, in the controlled flocculated and dispersed state.

When a mud has been properly converted with shale-control reagent to a P_m of 8 cc. or above and a filtrate calcium level of at least 400 p.p.m., the mud is in a satisfactorily controlled flocculated state. And, as long as it is maintained in an operating range of 8-12 cc. P_m with a calcium ion level of 400-1,000 p.p.m., the addition of shale-control reagent for maintenance proceeds with no abnormal reaction in regard to viscosities or gels.

However, if the chemical levels are allowed to drop, the mud moves towards a dispersed state. As the mud

Congrats and $25 for this quip to M. H. Barber, Continental Oil Co., Big Spring, Texas.



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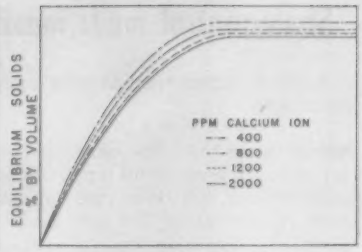


EFFECT OF CALCIUM CONCENTRATION on equilibrium solids level in the mud. Fig. 5.

begins to disperse the gels drop towards the 0-0 values associated with dispersed muds, the viscosity drops, and the physical appearance of the mud seems to improve. It is here that the value of "control by chemistry" can be appreciated. This apparent improvement could continue until the point is reached where the floc-controlling agent or dispersant becomes too low in concentration or moves out of its range of effective operation. At this point the mud will flocculate rapidly and severely with damage to the whole system.

Fortunately this condition is preceded by a much less severe effect. As the chemical balance drifts towards the dispersed state, cutting preservation efficiency weakens and viscosity buildup starts. This viscosity rise is shown in the diagram by the dotted line X-Y.

When the viscosity rises to a point requiring correction, Y, and correction is attempted by use of shale-control reagent, the high content of partially dispersed solids will not return to the floc-controlled state without developing intolerable viscosity and gel. The only simple way to return successfully again to the desired flocculated state of the shale control mud at this time is to reduce solids rapidly and rebuild the chemical balance before additional cutting dispersion can again raise the viscosity level.

This condition may be considered to be due to personnel failure, as the system is simple to maintain within a wide operating range and there is no need for such a condition ever to arise unless it is flagrantly neglected.

It will be noted on the diagram that a rise in the 10-minute gel value is shown for abnormally high mud alkalinities. To the writers' knowledge this has only occurred once and at a time when it had been necessary to drill approximately 1,000 ft. of flash-set cement from a string of 7-in. casing.

The difficulty appears to arise from an inability of the floc-controlling or dispersing agent to control the floc

completely under such a severe condition. After the maintenance treatment was reduced, the P_m dropped in a short time, and the condition rapidly corrected itself.

In Fig. 4 the shaded area indicates that there exists an area of demarcation, and not a distinct boundary between the flocculated and dispersed states. In this area exist many degrees of flocculation and dispersion depending on numerous factors such as: (1) concentration of and ratio of flocculating and dispersing agents; (2) nature and relative effectiveness of flocculating and dispersing agents, and (3) susceptibility of solids and system to flocculation, etc.

In the shale-control system the point of entry into the flocculated state appears to be more readily definable than a point of reentry into the dispersed state. Moreover, in this study the flocculated state has been more thoroughly investigated, and the area of reentry into the dispersed state has been of only academic interest since a shale-control system should never be allowed to operate under this condition.

The Controlled-Floc State

Fig. 4 represents the interrelated states of dispersion, flocculation, and controlled flocculation.

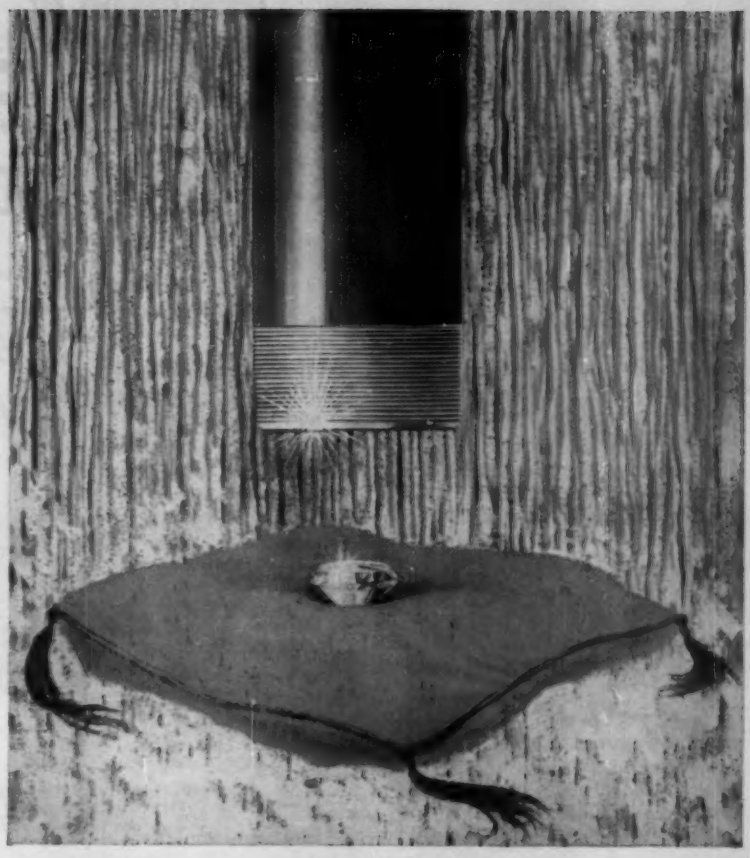
In the dispersed mud systems, heavy treatment with dispersants is used to maintain as nearly as possible a completely dispersed state A between the clay particles.

Opposing this dispersion is the influence of flocculants and flocculating influences such as salt, gypsum, high solids state, heat, and even in some cases, the chemicals originally added to aid the dispersion (overtreating effects). These tend to shift the system toward the partially flocculated state B.

The success of dispersion depends upon many factors. Some are the effectiveness and concentration of dispersant, the flocculation efficiency of the flocculants, and the nature of the system being subjected to flocculation. Calcium salts are normally considered severe flocculants but, in one presently used system, a system saturated with gypsum is effectively dispersed by massive treatments of dispersants.

The shale-control mud system relies upon controlled flocculation, i.e., the calcium flocculants are capable of flocculating the originally dispersed clays to a mass flocculated state D. Floc-controlling or dispersing agents are then employed to reduce this massive floc system to one of controlled size as idealized by stages C and B.

Being in this transitional state of



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The jeweler, in showing a fine stone, often displays it on a velvet cushion so that its true brilliance and beauty of cut will be most apparent to the viewer.

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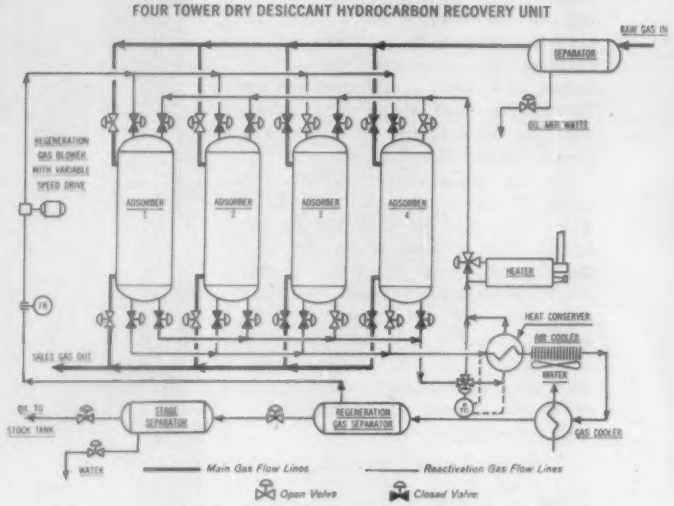
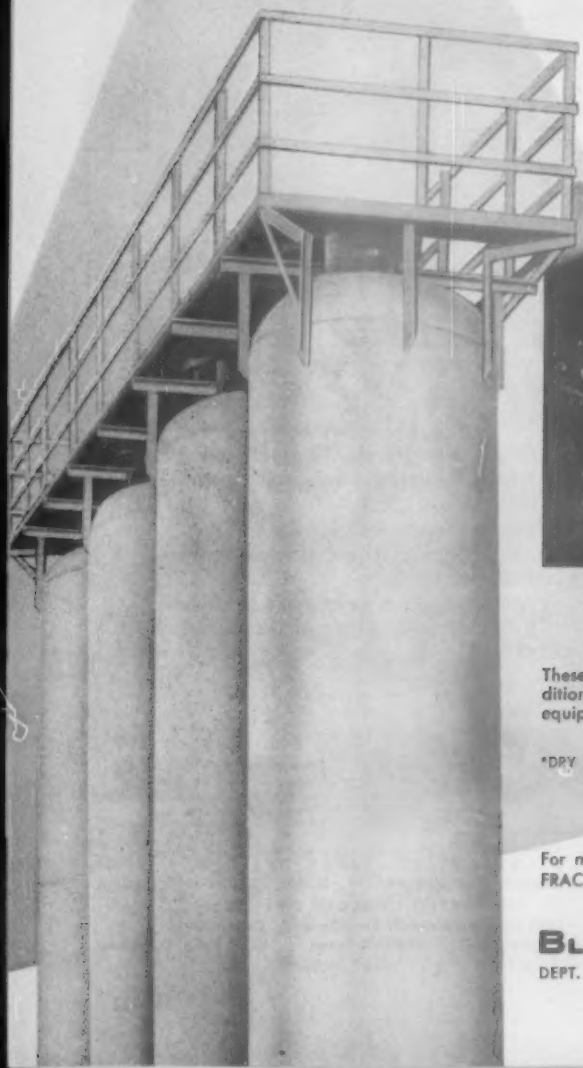
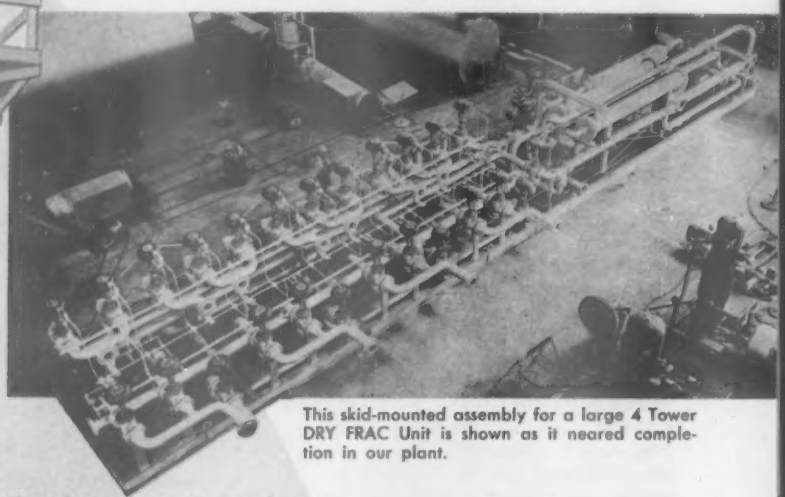


Flow diagram of a typical 4 Tower DRY FRAC Unit With Closed Cycle Regeneration. Smaller diameter towers and smaller valves of standard sizes contribute to reduction in cost of this type unit.



These four towers, with the addition of piping and accessory equipment, will complete the unit.



This skid-mounted assembly for a large 4 Tower DRY FRAC Unit is shown as it neared completion in our plant.

*DRY FRAC is a trade name of Black, Sivalls & Bryson, Inc.

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"The shale-control mud system relies upon controlled flocculation."

controlled flocs, the shale - control mud system possesses a great tolerance to contamination with extraneous flocculants such as salt, gypsum, cements, solids, etc. It requires sizable amounts of an effective flocculant to induce even a slight shift in the degree of flocculation of the system, and this can be readily corrected with a small counteracting treatment of floc-control agent.

Equilibrium solids in floc . . . After a shale control mud has been established in a controlled state of flocculation, field practice is normally to add sufficient new water to the system to maintain a constant surface volume of mud. In some cases where the volume of shales drilled is not high the mud will remain in a low solids state.

If, however, massive shales are being drilled, the mud builds up in solids. But experience has shown that a self-limiting condition is eventually reached at which time solids cease to accumulate in the mud. This we have chosen to call an "equilibrium solids" condition.

In any given well the value of this equilibrium solids condition bears an approximate relationship to the calcium level being maintained in the mud. Since calcium ion is a severe flocculant and tends to shift the mud towards the coarse floc state (C of Fig. 4) at a given ratio of floc-controlling agent, the equilibrium solids tends to exhibit an inverse relationship to the calcium level. That is, the higher the calcium level, the lower the equilibrium solids for a given viscosity and gel level. Fig. 5 represents these conditions graphically.

The importance of this relationship is best shown by example. Consider a well using shale-control mud, with a 400-600-p.p.m. calcium level that has been drilling massive shale and has thus reached an equilibrium solids state. If it encounters a strong calcium-contributing formation, such as anhydrite, the viscosity level will rise.

There are two approaches to correcting the situation: (1) either reduce the calcium level so that the degree of flocculation returns to the original level, or (2) adjust the floc-control agent and solids to a level compatible with the new conditions. The choice depends solely upon the anticipated future conditions of drilling.

If the problem is of a temporary character, the first alternative is best. If the condition is just one of a series of anticipated encounters with flocculating formations, anhydrite, salt, etc., the second procedure will prove more satisfactory and economic.

In most areas, as in the Rocky Mountains and Canada, where gypsum and anhydrite may be normal problems, shale - control muds are usually in a low solid state well below any equilibrium solids level and changes in flocculation state go practically unnoticed.

Controlled floc dispersion . . . Since the floc-controlling agent acts as a dispersant, and the reduction of floc size and partial dispersion result in lower viscosity and gels, the inexperienced might feel that this is a desirable condition. Shale-control reagents contain the proper quantity of floc-controlling agent for most normal conditions, and no other floc-controlling agent should be used unless the mud engineer has established that the flocculating environment of a specific system is sufficiently severe to justify supplementary treatment.

This balance between degrees of controlled flocculation and low-level dispersion will not basically affect the well-bore stability. Reason is that shale stabilization possesses a time dependency in that infusion of filtrate into the very low-permeability shales progresses at a reduced rate. The distortion of this balance shows itself primarily in the short-term reaction between mud and cuttings in the presence of severe agitation which in turn is reflected in a loss of some of the ability of the mud to suppress "mud-making."

Studies show the theoretical reasoning that, even though a system contains a normally considered flocculating agent, if it has been so treated as to yield a dispersed state, it will be a severe mud-making system. If this dispersing state is linked with a nonstabilizing mud chemistry, well-bore erosion will result. Whether and how soon this will lead to well-bore instability depends upon the character and susceptibility of the formations being drilled.

Effective clay modifier . . . Field tests were made to substantiate that the chemical environment in a shale-control mud is an effective clay modifier.

From the data it was apparent that the calcium level in this system is highly effective in replacing the sodium from the clays to yield a truly calcium-type-base mud clay. This clay modification coupled with the floc-controlled mud system explains the observation so often made that "shale-control muds all look alike."

Properties Vary From Area to Area

On the other hand, since dispersed muds reflect the type and character of the shales drilled, with little or no modification due to the chemicals in the mud, they vary widely in properties from area to area and from depth to depth in a given well.

Field-well histories show the high effectiveness of shale-control muds in stabilizing well bores and reducing costs through decreasing time lost in mud conditioning and the expense of mud conditioning materials. Table 1 presents a comparison of shale and mud performances of various mud systems based upon a summary of published literature, field-performance reports, and selected shale performance tests.

Next week . . .

Annual Drilling Issue

The LATEST TRENDS in drilling and a roundup of the nation's most active drilling areas will be featured in the Annual Drilling Contractors' Issue October 12.

Watch for these special features:

- A 16-page handbook on surface mud systems of drilling rigs.
- The new "turnkey" method of handling the drilling of a well.
- A list of more than 100 active drilling areas, including formations, costs, mud programs, and other valuable data.

Read next week's Journal for up-to-date, worth-while information on drilling.

Water-flood potential gives new glamor to old New Mexico fields

Experience gained in West Texas has been carried across the border to apply to the same producing zones in New Mexico. Twelve fields are now under active water-flood operations with more scheduled to come as operators view current results optimistically. BUT, the oil companies must make a profit on future operations.

BY KENNETH L. SMITH
Vice President, Ambassador Oil Corp., Fort Worth

THE OLD Permian fields in southeastern New Mexico are receiving industry-wide attention for their water-flood potential.

This is due to the success in flooding some of the same producing formations in West Texas. Most of the formations that have been flooded in West Texas have produced a significant amount of primary oil in southeastern New Mexico. Operators are now taking a good look at the possibility of extending the water-flood trend across the border.

Two successful water-flood units in the Caprock Pool in Lea and Chaves counties—operated by Ambassador Oil Corp. and Graridge Corp.—have further stimulated interest in New Mexico water-flooding projects.

The New Mexico Oil Conservation Commission has granted water-flooding permits for 12 fields—portions of which are now being subjected to water injection.

The water-flood projects which have been installed in the New Mexico fields are being applied to stripper-type producing wells. When the reservoir pressure is nearly depleted and its producing wells average only a few barrels of oil per day, the attempt to produce oil by water flooding is strictly a salvage-type operation. Pattern water-injection pilots are usually installed to see if a particular reservoir will respond to water flooding. Even with the best engineering data available the risk is often as great as drilling a wildcat to find primary oil. If the pilot is properly engineered and the reservoir is adaptable to water flooding, it may be possible to recover as much oil by water flooding as was originally produced by primary means.

Those companies who are experienced and successful water flooders will generally request from a state's conservation commission a capacity allowable for all producing wells within the flood area. There is an important reason for requesting a capacity allowable when the water-flooding technique is applied to a producing reservoir. Actual field experience has shown that if relatively high rates of water injection are not used much of the oil would be left in the reservoir, never to be recovered. To prevent waste and efficiently flood an oil reservoir, water must be injected into it at a sufficiently high rate to form as uniform an oil bank as possible. When an operator is permitted to pump his producing wells at capacity as water pushes the oil to the producing-well bore, he is not permitting any oil to go on by the well where it may be entrapped and not recovered.

Some individuals in the oil-producing industry do not understand what capacity water-flood allowable means or why it is necessary. Capacity allowables are mandatory in the interest of conservation and prevention of waste, and also for the protection of correlative rights. If the entire producing field to be water flooded was unitized, and all wells in the field were granted yardstick allowables on a unit basis, such as 36 bbl. of oil per day per well, no capacity allowable would have to be granted for water flooding.

A unit allowable is common in pressure maintenance projects. When such a unitized field is placed under water flood, a pilot program is installed and the pilot is gradually enlarged as the response to water injection justifies expansion. When a field is water flooded, some of the wells may produce oil at rates in excess of normal yardstick allowables; but on the unit-allowable basis the field average rate per well may be only a few barrels per day. When a field is totally under water-flood operation, the oil-producing rates for the field as a whole seldom go above that field's highest primary producing rate. This relationship has been proven many times in the actual performance of various Permian fields which have been flooded in the West Texas area.

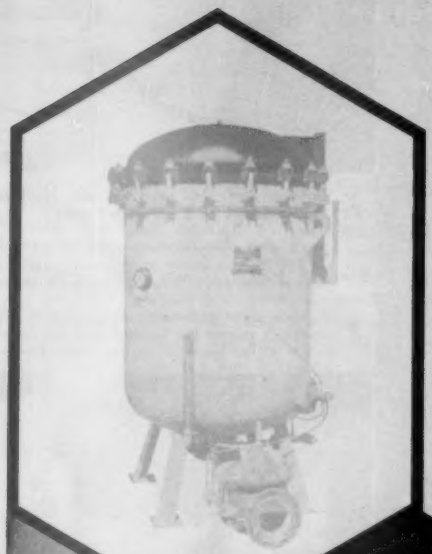
Another important reason for granting capacity allowables is apparent—

PRODUCTION DATA—NEW MEXICO FIELDS HAVING WATER-FLOOD PROJECTS

Production data include both water-flood and primary production. The last column is based on a 36-bbl. per day allowable. Total state-wide production for June 1959 was 8,551,342 bbl.

Pool name—	June prod.	No. of wells	Avg. daily per well prod.	Allowable field-wide pressure maintenance
Artesia	80,281	437	6.12	471,960
Caprock	422,727	682	20.66	736,560
Corbin	5,295	26	6.79	28,080
Grayburg-Jackson	114,526	416	9.18	449,280
High Lonesome	14,983	37	13.50	39,960
Langlie-Mattix	181,609	933	6.49	1,007,640
Loco Hills	31,376	256	4.09	276,480
Red Lake	23,914	163	4.89	176,040
Russell	11,636	60	6.46	64,800
Shugart (North)	11,760	58	6.76	62,640
Square Lake	49,312	281	5.85	303,480
Vacuum	270,087	493	18.26	532,440
Total	1,217,506	3,842	10.56	4,149,360

(Information taken from New Mexico Engineering Committee's monthly statistical report for June 1959.)

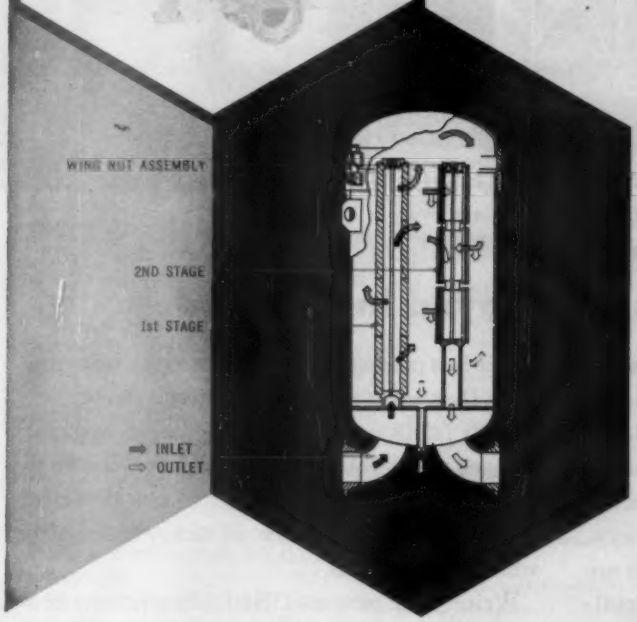


PROBLEM:

WATER AND DIRT IN PETROLEUM PRODUCTS

SOLUTION:

WARNER LEWIS TWO STAGE SEPARATOR/FILTERS



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Clean hydrocarbon and any entrained water droplets flow to the separator cartridges. This chemically-treated media completely blocks the passage of water and clean hydrocarbon passes through the cartridges to the outlet.

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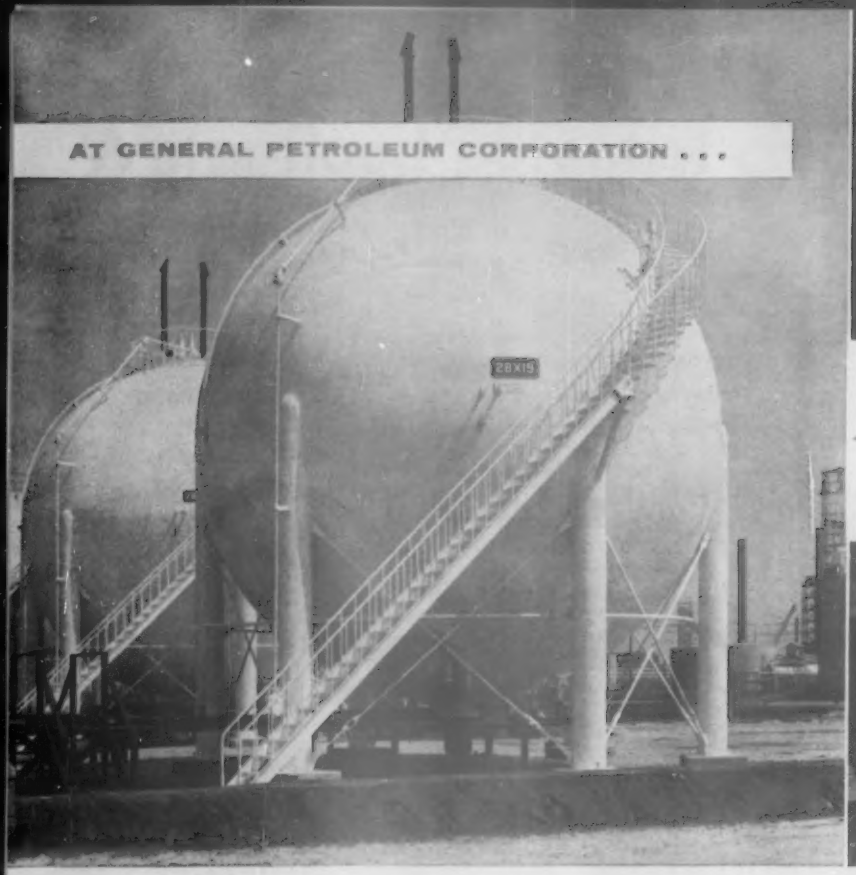

Portable X-ray unit used by CB&I to inspect welded seams on field erected work.

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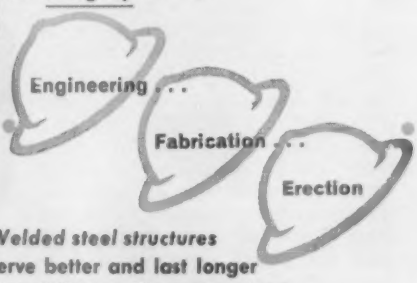


Welded steel structures **serve better and last longer with CB&I coordinated services.**

field-wide unitization is not always possible. At times, several units are formed in one field, and at other times it is not possible to unitize at all. In the latter instance, water floods are carried out on a cooperative basis. Those operators fortunate enough to have exceptionally large leases can spread their production to enough wells so they can effectively flood without requiring a capacity allowable. However, many operators are not fortunate enough to own such large leases. When an oil front generated from one direction by water injection reaches the producing-well bore, individual wells must produce at capacity or the oil will be driven from the lease. The smaller the lease, the more imperative it is to have capacity allowables to permit an efficient water-flood operation.

If capacity allowables are not granted, forced unitization may have to be resorted to in order to economically flood a particular reservoir. If the reservoir is not unitized or capacity allowables are not granted, two factors become paramount: (1) High efficient injection rates cannot be used, resulting in a large reduction in water-flood recovery; (2) the owner of a small tract would lose oil by not being able to produce it when it is pushed to his producing well.

The recent increase of water-flood activity in New Mexico has caused many people to ask the question, "What effect does this water-flood production have on the state's oil market?" The actual effect has been very insignificant. Water-flood production comprises considerably less than 5% of the total oil produced in the State of New Mexico. The allowable for August for those properties under water flood was only 320,788 bbl. compared with a total state-wide production of more than 8,000,000 bbl. per month.

The accompanying table lists pertinent data on 12 fields in New Mexico now being water flooded. A comparison is made in this tabulation showing what these fields could be producing under the normal unit allowable schedule had they been placed under a pressure-maintenance type of operation when the field was originally developed. If such were the case, they would be producing nearly four times what they are presently producing under a stripper-primary and water-flood program. These fields all had original flush primary production which rapidly declined to a low per well rate. Now they are being subjected to water flood and in time each field will probably approach the original primary producing rate. As a matter of comparison, a field which produces primary oil may have a life of 20 years because it first goes through a flush period of production, declining down to a depleted stage, and later is water-flooded. A field produced in this manner could have an average per well daily producing rate of 18 bbl. of oil. Had this field been placed under a pressure-maintenance program, it could have produced 36 bbl. of oil per day per well for a 10-year period. The total oil produced in each case would be the same but the average rate under capacity flooding after depletion would only be one-half that of pressure maintenance. It can be seen if there is to be any adverse effect on the oil market at any given time, the pressure-maintenance type of operation would be the most significant.

The most efficient method of producing oil is to apply pressure maintenance to the fields during their early stages of development. Both the state regulatory bodies and conservation-minded oil companies now advocate this and are attempting to encourage pressure maintenance wherever it is applicable. The stripper water flooder is trying to salvage crude reserves from old depleted oil fields. If the wells are plugged in these old fields the oil will be lost forever because the cost of redrilling would not permit a payout. Those companies who are now engaged in the water flooding of old depleted and stripper-type fields should be encouraged to continue their operations. But they can stay in business only as long as there is a reasonable profit to be made.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, Technical Editor, and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issues of the months of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis):

Explained on page 101 of the issue of August 5, 1957.

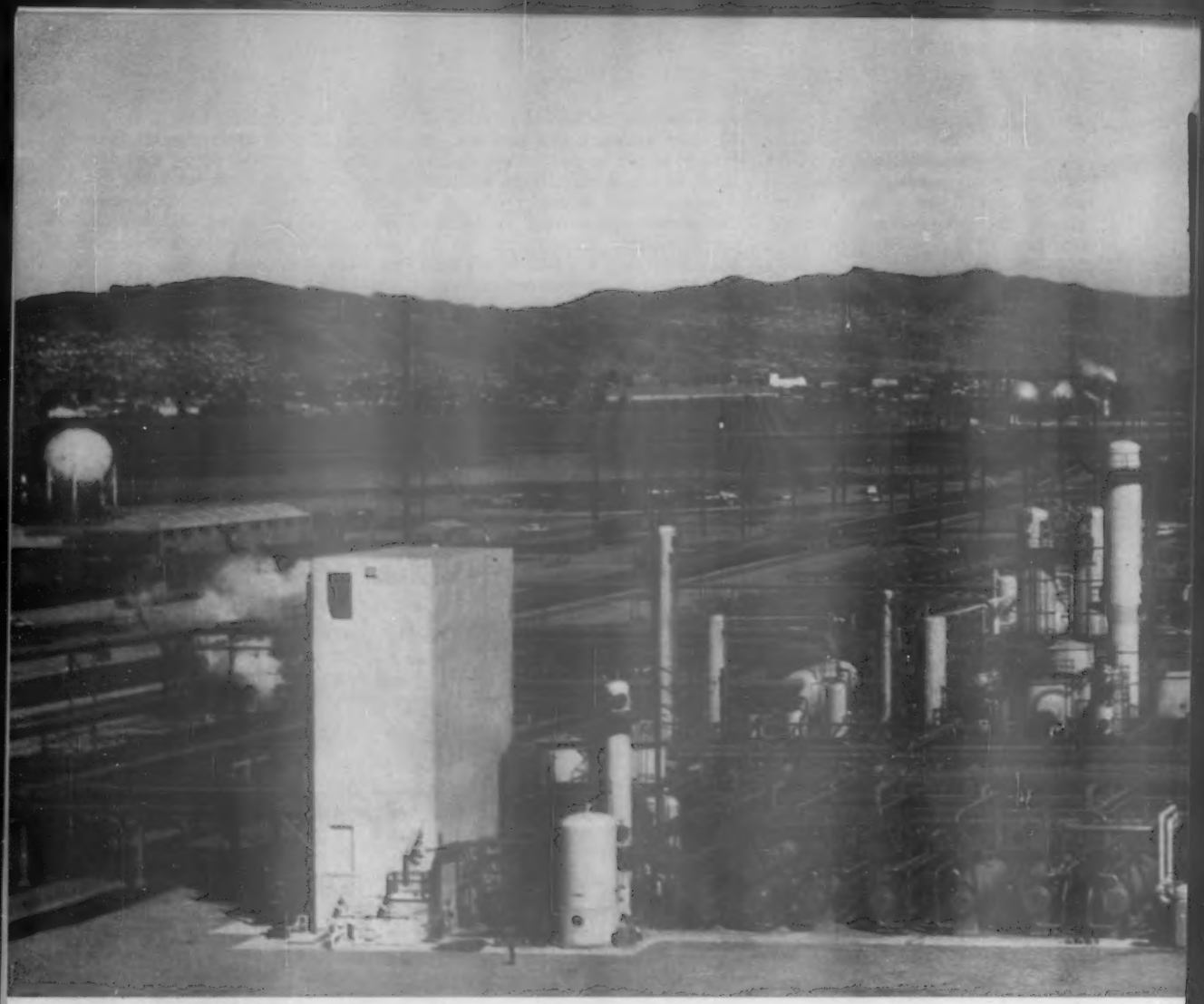
	1950	1954	1956	1957	1958	June 1959
Pumps, compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.5
Electrical machinery	134.9	160.0	175.0	188.9	192.7	195.4
Internal-combustion engines	126.0	150.5	164.0	173.9	178.3	178.6
Instruments	127.8	154.6	182.1	187.4	194.9	204.1
Heat exchangers	140.0	171.7	190.7	203.6	181.2	177.1
Misc. equipment average	*126.2	160.7	180.5	192.1	192.4	196.3
Materials component	149.5	174.6	190.4	201.9	204.2	207.2
Labor component	144.0	183.3	198.2	208.6	220.4	230.2
Nelson construction index	146.2	179.8	195.3	205.9	213.9	221.0

*Used in computing the Nelson index until April 1952.

Refinery Operating Cost Indexes (1956 Basis):

Explained on page 171 of the issue of June 1, 1959.

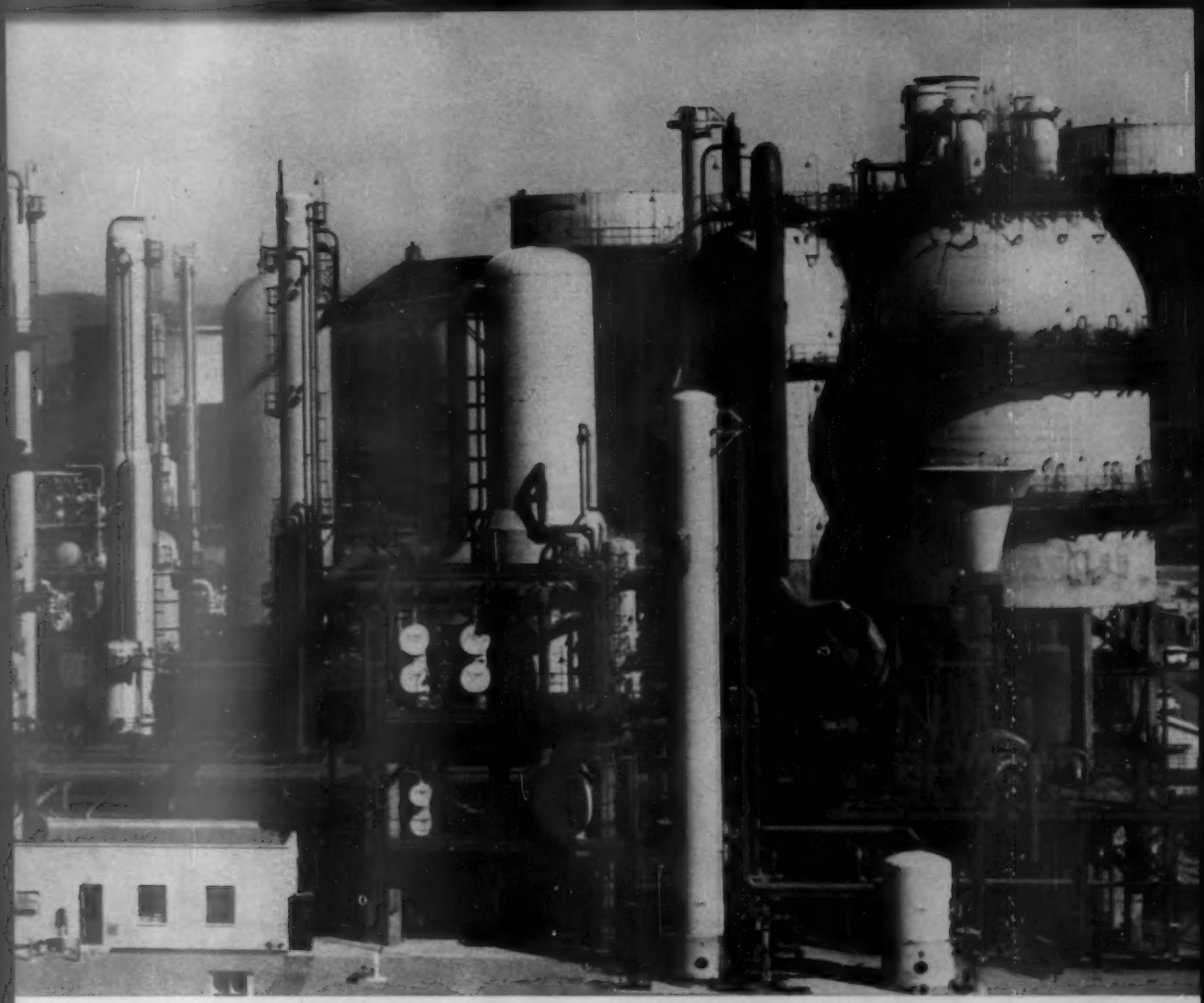
	1946	1952	1954	1957	1958	April 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	104.8
Labor cost	73.1	88.7	90.9	106.1	105.0	107.0
Wages	52.4	81.5	88.7	104.1	105.4	113.0
Productivity	68.3	90.2	97.1	98.1	100.3	105.6
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	112.0
Chemicals cost	37.0	72.1	85.7	102.2	104.4	104.2
Operating cost indexes:						
Refinery	58.5	80.5	88.7	106.4	105.9	107.7
Process units	62.9	82.2	88.4	107.1	105.8	108.1



What's new in cat crackers?

The art of catalytic cracking has reached a highly advanced state. The improvements and refinements that now take place as new crackers are built seem minor indeed when one recalls the series of spectacular breakthroughs that followed one after another during cat-cracking's first eventful decade.

Yet there is drama even today. Sometimes it takes the form of a successful race against time. A record of sorts was set recently when the unit above was completed by Fluor for Standard Oil Company of California at its Richmond refinery on San Francisco Bay. It is an Esso Model IV



Fluid Catalytic Cracker with a capacity of 55,000 barrels per day, and it was delivered to the customer in time for the summer marketing season—two weeks less than one year after work began.

It is one of the two largest Model IV's in existence. The other, of the same capacity, was built by Fluor in 1954 for Standard at El Segundo. The Richmond and El Segundo units are almost identical except for auxiliaries (Richmond has a fired heater, a CO boiler and water-treating facilities). A few minor design and material changes, based on experience at El Segundo, were incorporated into the new unit.

The job was begun on June 2, 1958, and completed May 15, 1959. Credit for the fast completion is due to many factors—organization, planning, fine co-operation from customer and suppliers, and good luck. But perhaps the most important element of all was Fluor's broad experience in the design, engineering and construction of cat crackers—nearly thirty of them since 1940.

A Fluor brochure, "FCC at Richmond," describes this interesting unit. Write to Dept. 40, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.

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Engineers & Constructors

BY W. L. NELSON, Technical Editor and Petroleum Consultant

COSTimating

Itemized Cost Indexes

THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction Cost Index is published in the first issue each month of The Oil and Gas Journal.

	1950	1954	1956	1957	1958	May 1959	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electric, industrial	97.3	¶98.5	100.0	¶101.3	103.7	103.9	Code 541-03	
Fuel, refinery	70.3	86.5	100.0	112.4	102.6	105.1		No. 4—Mar. 17, 1958
Gulf cargoes	78.0	85.9	100.0	123.8	102.9	93.5		No. 4—Mar. 17, 1958
N. Y. barges	76.9	82.6	100.0	112.3	93.0	85.9		No. 4—Mar. 17, 1958
S. Pedro bunkers	65.8	84.3	100.0	129.2	114.6	99.5		No. 4—Mar. 17, 1958
Oklahoma	77.7	62.0	100.0	105.3	66.3	87.4		No. 4—Mar. 17, 1958
Natural gas at wellhead	60.2	88.9	100.0	101.8	119.4	132.0	Code 531-01	
Industrial chemicals	83.3	96.9	100.0	101.9	101.8	102.1	Code 61	
Phosphoric acid	86.7	96.6	100.0	100.9	103.4	103.4	Code 611-07	
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	
Ammonia	104.8	103.0	100.0	98.3	103.8	106.5	Code 611-13	
Lime	64.6	92.0	100.0	106.4	104.4	106.4	Code 611-29	
Sodium carbonate	75.5	92.9	100.0	104.3	104.3	104.3	Code 611-65	
Sodium hydroxide	76.3	90.9	100.0	103.6	112.6	115.7	Code 611-69	
Sodium phosphate	87.5	95.5	100.0	101.1	104.6	104.6	Code 611-71	
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 617-63	
MEK, drums	80.0	94.5	100.0	105.2	106.9	103.3	Ch. & E. News	
Phenol	81.3	90.4	100.0	103.2	102.7	95.2	Code 612-83	
TEL	94.1	102.8	100.0	101.5	99.9	117.3	Supplier	
Operating labor (wages)	72.0	88.7	100.0	103.9	105.4	112.2	Employ. & Earn.	No. 53—Nov. 3, 1949
Productivity	85.5	97.1	100.0	98.0	100.3	104.9	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	187.3	196.3	205.1	212.1	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	209.2	221.0	235.7	245.4	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	198.2	208.6	220.4	228.7		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery		158.4	180.2	186.6	193.2	192.6	Code ‡1176	May 2, 1955§
Boilers, tanks, and sheet metal	†136.0	147.3	168.0	176.3	175.1	175.7	Code 1072	Apr. 21, 1952§
Building materials (nonmetallic)	127.0	143.6	154.0	159.9	161.7	164.4	Code ‡13	No. 22—Mar. 17, 1949
Brick-building	132.5	144.7	159.2	161.3	162.4	166.6	Code 1341	No. 20—Mar. 3, 1949
Brick—fireclay	153.4	193.1	218.1	232.7	238.7	244.5	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	204.7	220.5	227.2	230.9	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	176.9	184.0	187.0	191.3	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	153.3	159.7	163.2	164.6	Code 132	No. 22—Mar. 17, 1949
Concrete—products	124.4	138.5	144.9	149.0	151.0	152.9	Code 133	
Electrical machinery	134.9	159.9	175.0	¶188.6	192.7	194.2	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	169.6	181.2	186.4	187.6	Code ‡1173	No. 31—May 19, 1949
Switchgear		171.2	194.9	¶212.0	218.8	224.8	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	175.4	188.0	187.3	188.2	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	164.0	173.9	178.3	178.6	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	¶190.7	203.6	181.2	176.4	Manufacturer	No. 2—Oct. 28, 1948
Copper base		¶190.7	198.8	191.4	168.8	168.0	Manufacturer	
Steel		¶156.8	178.6	213.2	190.0	183.0	Manufacturer	
Fans and blowers	162.9	192.6	222.4	236.1	241.7	244.1	Code 1147	Feb. 17, 1948§
Hand tools	143.2	173.8	200.3	214.3	224.7	230.5	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	182.1	187.4	194.9	204.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	203.3	209.9	219.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	203.9	208.2	216.3	223.5	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	170.2	171.2	176.4	179.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	211.8	230.9	240.4	265.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	192.3	204.6	212.6	231.6	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	187.1	189.3	200.0	200.0	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.7	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	170.2	171.8	179.3	179.7	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	180.9	187.8	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	214.5	201.8	198.9	217.3	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	195.0	187.6	184.7	189.9	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	266.5	257.6	251.2	267.2	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	183.8	196.5	199.6	203.0	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	187.4	199.4	209.6	216.8	Code 112	
Oil field	†135.8	†161.9	†179.3	193.2	192.5	192.6	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	169.2	178.1	180.9	180.9	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	160.5	168.0	170.1	174.9	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	233.0	256.1	264.8	263.8	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	241.2	268.3	276.9	275.9	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.4	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	209.0	224.5	228.2	230.2	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	212.4	232.5	240.6	244.6	Code 1014	July 25, 1955§
Plate		187.0	215.9	241.8	252.7	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	219.1	252.2	262.8	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	235.5	265.4	277.5	285.1	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	231.9	243.4	242.7	243.8	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	195.3	205.9	213.9	219.9		No. 61—Dec. 15, 1949
Nelson Ref. Operation (1956)	72.4	88.7	100.0	107.0	105.9	108.1		No. 2—Mar. 3, 1958
Nelson Ref. Process Oper. (1956)	75.1	88.4	100.0	108.1	105.8	108.3		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."

†Estimated base value for 1946.

‡Not exactly the same items as those published before July 7, 1952.

§Questions on Technology, The Oil and Gas Journal. ¶Revised.

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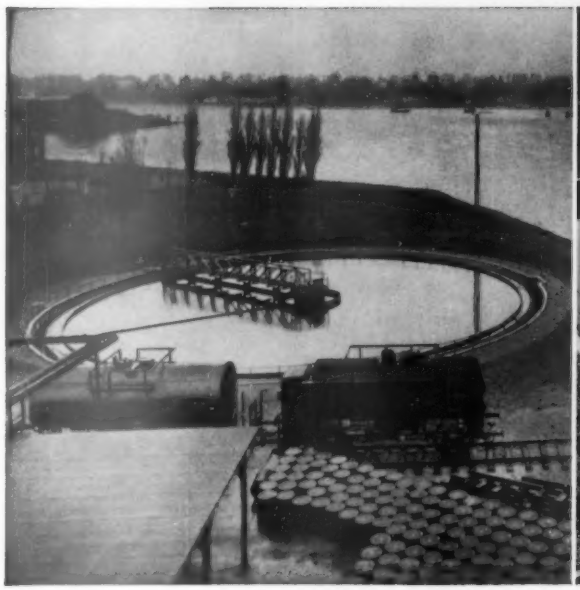

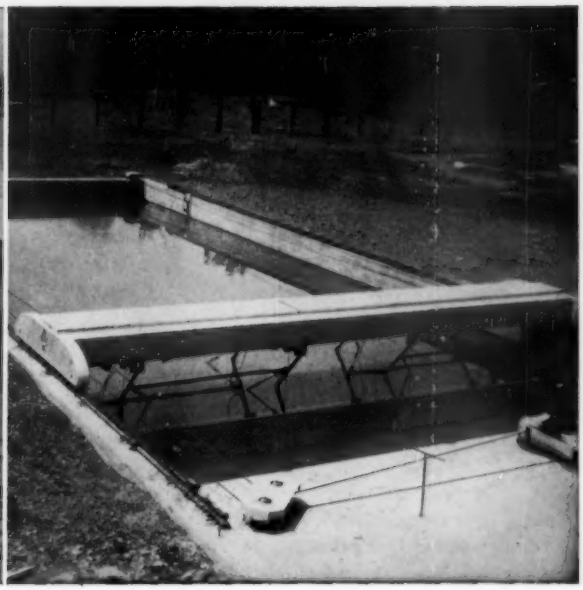

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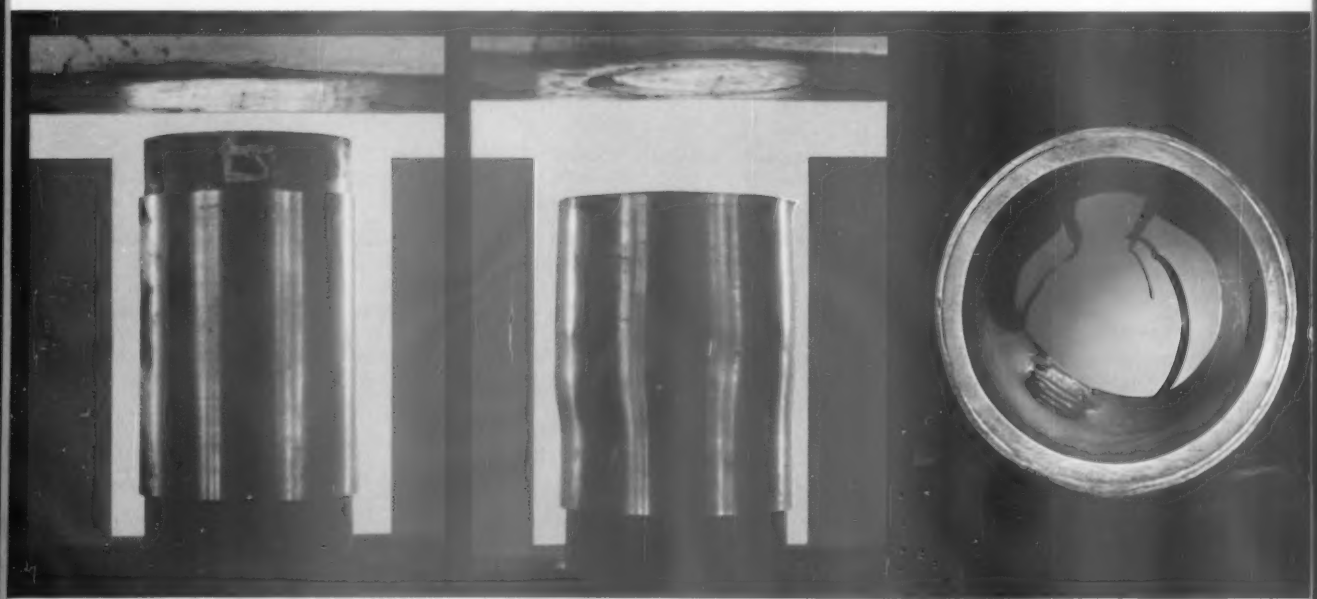
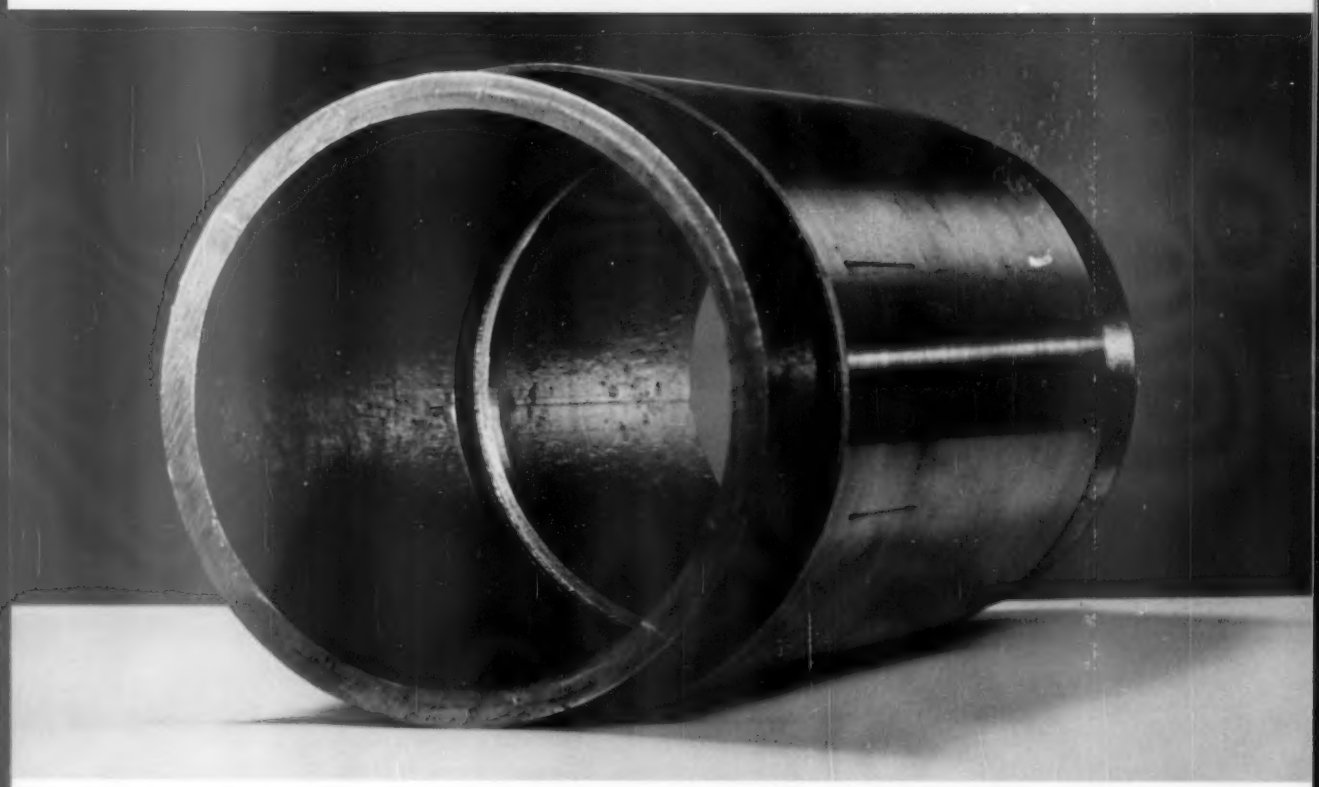


1. **Under the power hammer.** The red cards in the rear provide straightedge for measuring distortion.
2. **After six blows with the power hammer.** The top section of casing has been driven down completely out of sight, barreling the coupling.
3. **Inside coupling.** Threads torn loose, sections of casing completely deformed, but the coupling did not fail.

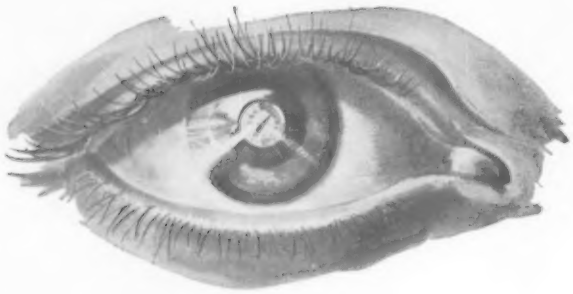


BEFORE ↑

A National Super Deep-Well Coupling, containing two sections of 7⅝" O.D. Deep-Well Casing with Buttress-Thread. Each section projects 2" from coupling.

The power hammer has driven one section of the casing into the coupling to meet with the other section. Both sections are a mass of distorted and twisted steel, yet the casing coupling did not fail.

AFTER ↓



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14. How to determine effective permeability

(d.) From pressure-buildup data under finite boundary conditions.

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa,

and

F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: The following data were obtained from a pressure-buildup of a Lea County, New Mexico, well producing from the Pennsylvanian sand.

Shut-in time, hours Θ	$\frac{t+\Theta}{\Theta}$	Sand-face pressure, p_w psig.
0	.....	2,996
0.59	17,000	3,282
0.74	13,500	3,290
1.00	10,000	3,300
1.25	8,000	3,308
1.50	6,670	3,316
2.94	3,400	3,319
5.88	1,700	3,323
9.10	1,100	3,327
25.00	400	3,327
50.00	201	3,327

Assume reservoir to be finite with cumulative oil production from well, N_p = 133,300 stock tank barrels.

Allowable, Q_o = 320 bbl. per day.

Viscosity of oil, μ_o = 0.25 cp. at reservoir conditions.

Oil formation-volume factor, β_o = 1.7.

Oil-compressibility factor, c_o = 12 × 10−6 vol./vol./psi.

Original reservoir pressure, p_o = 3,410 psi. or pressure at last survey.

Porosity, ϕ = 0.05.

Radius of drainage, r_e = 1,052 ft.

Net sand thickness, h = 26 ft.

Radius of well, r_w = 0.27 ft.

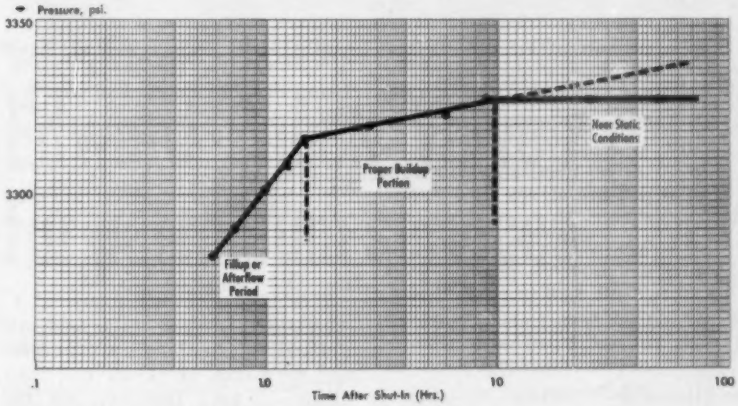
FIND: 1. After flow period, proper buildup portion, and near static conditions from a plot of p_w vs. log Θ.

2. Reservoir pressure and average effective permeability using Horner and Miller, Dyes, and Hutchinson methods.

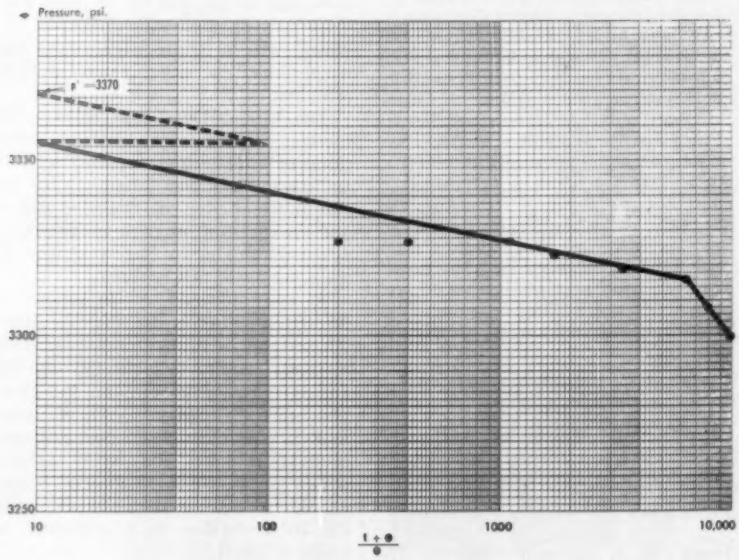
METHOD OF SOLUTION: The following equations are used in solving the problems by the Horner method.[1]

$$\text{Slope} = m = \frac{p_{w2} - p_{w1}}{\log [(t+\Theta)/\Theta]_2 - \log [(t+\Theta)/\Theta]_1} \quad (1)$$

$$k_o = 162.6\, Q_o \mu_o \beta_o / m\, h \quad (2)$$



PRESSURE-BUILDUP CURVE, Miller, Dyes, and Hutchinson method. Fig. 2.



PRESSURE-BUILDUP CURVE, Horner Method. Fig. 1.

$$p^* = p_o - \frac{m}{2.303}\, y(u) \quad (3)$$

$$p_s = p_o - \frac{m}{2.303\, u} \quad (4)$$

By the Miller, Dyes, and Hutchinson method[2] these equations are needed:

$$\text{Slope} = m' = \frac{p_{w2} - p_{w1}}{\log \Theta_2 - \log \Theta_1} \quad (5)$$

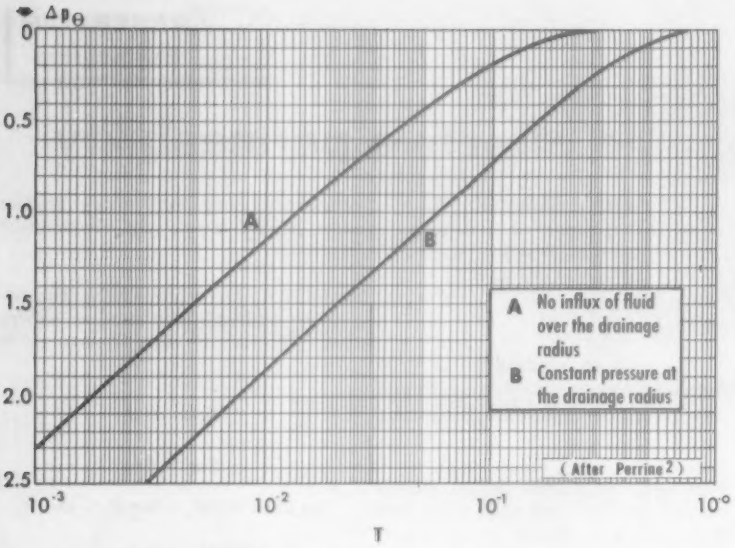
$$k_o = 162.6\, Q_o \mu_o \beta_o / m'\, h \quad (6)$$

$$T = 0.000264\, k_o \Theta / \phi\, c_o \mu_o r_e^2 \quad (7)$$

$$p_s = p\Theta + (\Delta p\Theta)(m')/1.15 \quad (8)$$

Where:

Q_o, μ_o, β_o, c_o, p_o, ϕ, r_e, h, r_w are defined with the data and



PRESSURE-BUILDUP CURVES for ideal formations. Fig. 3.

p' = pressure at log $(t + \Theta)/\Theta$ = 0, psi.

$y(u)$ = independent variable = $(1/u)\, e^{-u} + E_1(-u)$

$u = r_e^2\, \phi\, \mu_o\, c_o / 4\, k_o\, (t + \Theta)$

p_s = current reservoir pressure, psi.

p_Θ = pressure at any time Θ after shut-in.

Θ = time after shut-in, hrs.

Δp_Θ = dimensionless pressure drop. $= .00708\, k_o\, h\, (p_s - p_w)/\beta_o\, \mu_o\, q_o$.

t = time from initial completion of well based on N_p and Q_o, or time from last pressure survey, hrs.

k_o = effective permeability, md.

T = dimensionless time.

SOLUTION: Using the Horner method,

$$t = \frac{N_p}{Q_o} = \frac{133{,}300 \text{ bbl.}}{320 \text{ B/D}} \times 24 \frac{\text{hrs.}}{\text{day}} = 10{,}000 \text{ hrs.}$$

The slope m is computed with data obtained from Fig. 1, using abcissa values of 1,000 and 100.

$$m = \frac{3{,}341 - 3{,}327}{\log 1{,}000 - \log 100} = 14 \qquad \text{(Eq. 1)}$$

$$K_o = \frac{(162.6)(320)(0.25)(1.7)}{(14)(26)} = 60.7 \text{ md.} \qquad \text{(Eq. 2)}$$

$$3{,}370 = 3{,}410 - (14/2.3)\, y(u) \qquad \text{(Eq. 3)}$$

$y(u) = (3{,}410 - 3{,}370)\ (2.3/14) = 6.56$

Using Fig. 10 of Ref. 1 or Fig. 6 of Ref. 3

$$u = 0.104$$

$$P_s = 3{,}410 - \frac{14}{(2.3)(0.104)} = 3{,}351 \text{ psi.} \qquad \text{(Eq. 4)}$$

$$T = 1/4u = 1/\ 4 \times 0.104 = 2.4$$

From Fig. 7 of Ref. 3 the correction for a slope of 14 and $T = 2.4$ is about -5 psi. Therefore, the corrected reservoir pressure is

$$p_s = 3{,}351 - 5 = 3{,}346 \text{ psi.}$$

In the Miller, Dyes, and Hutchinson method, the slope m′is computed with data obtained from Fig. 2. Thus using abcissa values of 1.0 and 10,

$$m' = \frac{3{,}326 - 3{,}313}{\log 10 - \log 1} = 13 \qquad \text{(Eq. 5)}$$

$$K_o = \frac{(162.6)(320)(0.25)(1.7)}{(13)(26)} = 65.3 \text{ md.} \qquad \text{(Eq. 6)}$$

For a shut-in time of 2 hours.

$$T_2 = \frac{(0.000264)(65.3)(2)}{(.05)(12 \times 10^{-6})(0.25)(1{,}052)^2} = 0.21 \qquad \text{(Eq. 7)}$$

From Fig. 3, and using curve A, $\Delta p_2 = 0.1$ and

$$P_s = 3{,}317 + \frac{(0.1)(13)}{1.15} = 3{,}318 \text{ psi.} \qquad \text{(Eq. 8)}$$

Fig. 2 shows the afterflow period, proper buildup portion, and near static conditions.

DISCUSSION: This problem is a good example of the use of two methods for computing effective permeability and static reservoir pressure from pressure-buildup data. Both methods involve equations resulting from the solution of the diffusivity equation.

$$\frac{\delta^2 p}{\delta r^2} + \frac{1}{r}\frac{\delta p}{\delta r} = \frac{\phi\, c\, \mu}{k}\frac{\delta p}{\delta t} \qquad (9)$$

Common assumptions involved in the solutions are: (1) an undersaturated, single fluid phase is flowing; (2) the reservoir fluid properties are constant at all reservoir conditions; (3) rate of production is stabilized before shut-in; (4) no fluids are produced into the well bore after shut-in; (5) sand properties are uniform; (6) drainage-area shape is that of a horizontal circular cylinder; (7) well bore is vanishingly small.[2] Obviously all of these assumptions cannot be satisfied by any reservoir. However, experience has shown that all assumptions need not be fulfilled for practical application of the results.[2]

Horner's method involves a solution of Equation 9 which is approximate and applicable for finite boundary conditions (pressure disturbances have been felt at r_e) and no influx of fluid over the drainage radius.[1] This method has been shown to be of practical value in most cases and can be corrected in the rest by utilizing Fig. 7 of Ref. 3. Generally the error involved will be appreciable where the permeability is low and production rate high.

The Miller, Dyes, and Hutchinson method involves more rigorous solutions of Equation 9 for two sets of finite boundary conditions: (1) No influx of fluid over the drainage radius and (2) constant pressure at the drainage radius. The former was used in the solution of this problem.

A careful study of Equations 1 through 8 will show that the two methods are similar in many respects. Both methods require reliable Q_o, μ_o, β_o, and h values. Furthermore, the Horner approach requires a reliable original or previous survey pressure and production data. The other method would require reliable values of r_e and c_o. Where reliable data are available the latter (Miller, et al.) method is easier to apply.

Note that the Horner technique in-

volves a plot using log $(t+\Theta)/\Theta$ as abcissa whereas Miller at al. use log Θ. Actually, for small values of Θ it can be mathematically shown that the slopes obtained should be about equal as was the case in the problem.

It can be observed in both Figs. 1 and 2 that the well was shut in long enough to build up to the approximate reservoir pressure of 3,327 psi. thus providing a good test for the methods. The Horner method resulted in a high value of 3,346 psi. (0.6% error) while the Miller, et al. method resulted in a low value of 3,318 psi. (0.3% error). The latter value would have been improved slightly if total compressibility (oil + water + rock) had been used. In spite of this, however, both values can be considered of practical value. Because it is based on more rigorous equations, the Miller et al. approach is considered by many to be the better method.[2]

Although relatively new, the methods used to solve this problem have received wide acceptance in industry and are being used extensively. Involved in the testing are large portions of in-place rock which should give more representative results of effective permeability. At a later time problems will be presented to show further utilization of pressure-buildup data for determination of well-bore damage and success of workover operations.

Errata in Part 13
Vol. 57, No. 33, August 10, 1959

Equation 1 should be written as

$$p_w = p_o - \frac{162.6\, Q_o \mu_o \beta_o}{k_o h} \log \frac{t+\Theta}{\Theta}$$

and Equation 2 as

$$m = \frac{162.6\, Q_o \mu_o \beta_o}{k_o h}$$

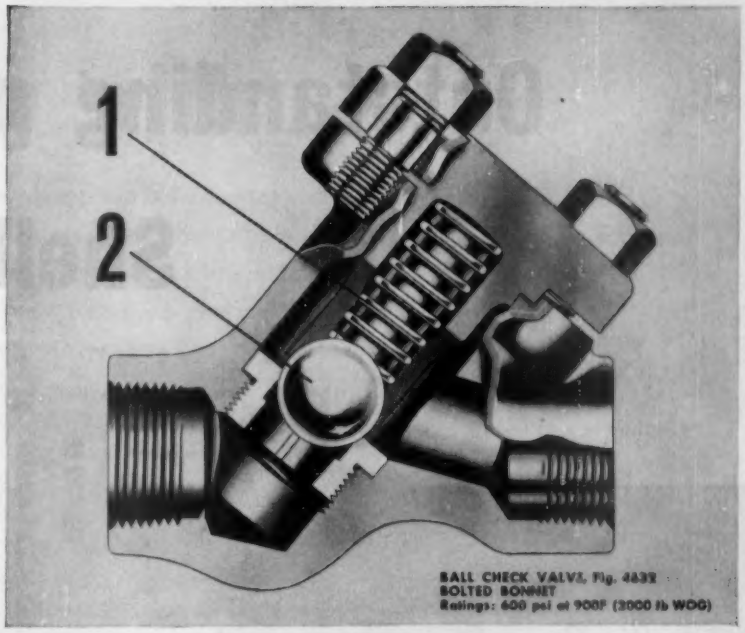
Therefore in the solution of Part 3

$$k_o = \frac{(162.6)\,(125)\,(0.8)\,(1.25)}{(28)\,(15)} = 48.4 \text{ md.}$$

In Equations 1 and 2 β_o belongs in the numerator instead of the denominator.

References

1. Horner, D. R.: "Pressure Buildup in Wells," Proceedings Third World Petroleum Congress, Section 2 (1951), pp. 503-521.
2. Perrine, R. L.: "Analysis of Pressure-Buildup Curves," API Drilling and Production Practice, 1956, pp. 482-495.
3. Hurst, L. L., and Guerrero, E. T.: "Calculating Static Bottom-Hole Pressures," The Oil and Gas Journal, Sept. 29, 1958.



BALL CHECK VALVE, Fig. 4432
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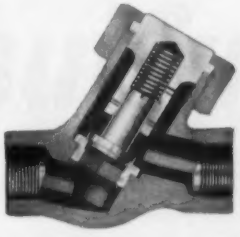
PISTON CHECK VALVE, Fig. 3378
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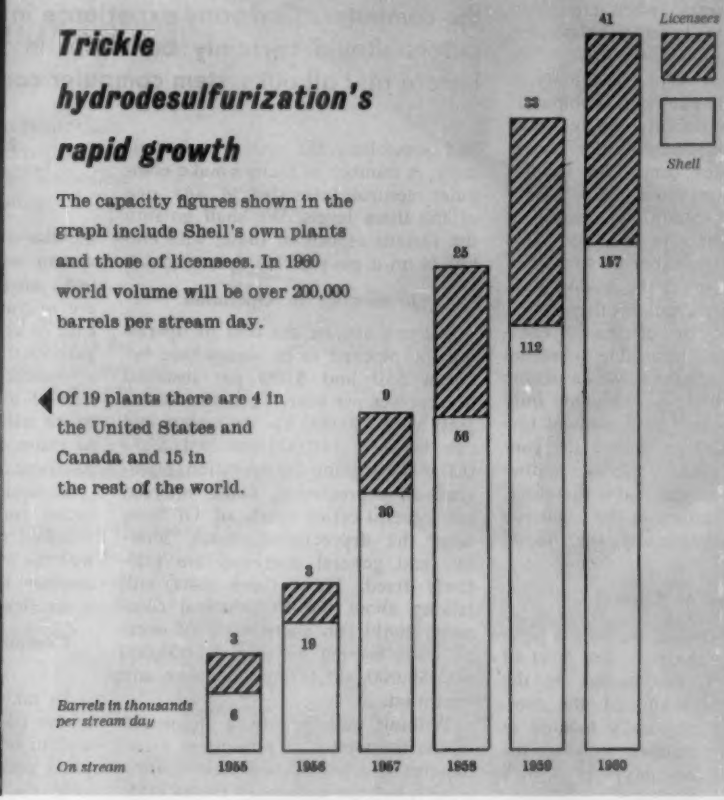

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Before you go all out for

Computer control for your pipeline:

Pause and ponder . . .

• Which level of control is best for your pipeline? Planning the steps to a given level in phases may be the proper answer. Getting into remote control gradually and testing telemetering, communications, and supervisory-control equipment provide the setting for more and more help from the computer. Company experience in using electronic computers should certainly be useful in the transition period before any all out system computer control plan is adopted.

BY J. T. MANRY III
Tennessee Gas Pipeline Co.

AS THE DEVELOPMENT of the computer moves ahead, the eyes of the pipeline industry are being forced to look into the computer possibilities for its individual operations. Computer speeds that were fantastic a couple years ago are thought to be relatively slow now, when compared to those of the latest transistorized electronic digital computers. The promise of much greater reliability in the use of transistorized computers gives added desirability where space and power requirements are a factor.

In a computer control of the facilities of a pipeline, it is necessary to simulate the conditions existing at the various levels of activity. This can be done with either of two types of computers. One is the analog type, which physically simulates the process by mechanical or electronic components arranged according to actual operation. The second is the electronic digital type, which can simulate only by being given the mathematical formulas and data to calculate the conditions. The accuracy of the mathematical formulas and data, therefore, are the main factors in the accuracy of the computation by the digital computer.

Types of Control

If computer control of the gas pipeline is to be considered, the level of control must be determined. In the first level to be examined, the computer could be physically located at the compressor stations to keep the compressor engines properly loaded and the station pressures maintained according to orders from the dispatcher. Another level with many possibilities is that of having a central computer at the main office which would provide sufficient information to a dispatcher to remotely operate the pipeline system.

The third level of control that is possible, if it is not desirable to have individual computers at each station, is the large central computer at the main office receiving all field data and controlling the system automatically. A number of factors make computer control attractive at any one of the three levels. We shall go into the various aspects of these, with emphasis on a gas-pipeline operation.

Paper presented before AIEE, Long Beach, Calif., August 23-26, 1959.

Economics in Operation

We can assume the cost of operating the pipeline to be somewhere between $50 and $100 per installed horsepower per year. Then for a company with 200,000 hp. the cost would run between $10,000,000 and $20,000,000 including the operation, maintenance, depreciation, taxes, interest, and general office overhead. Of these costs the depreciation, taxes, interest, and general overhead are relatively fixed. These fixed costs, still talking about the hypothetical company, could run about 60% of overall costs leaving between $4,000,000 and $8,000,000 for maintenance and operation.

Without getting into a discussion of the economics of preventive maintenance and breakdown maintenance, a fairly definite amount of the $4,000,000-$8,000,000 could be applied to maintenance, still leaving several million dollars for direct operating costs. It seems reasonable to assume that computer control would have this area of operations costs to work with.

A question often asked is, "Just how much is the computer control worth in dollars to your company?" A consultant armed with the answer to that question could come up with all sorts of plans to fit the price established. Unfortunately the evaluation of the cost of operation through the use of computers controlling the system cannot be fully ascertained until after the die is cast and you are operating on that system. In the case of companies not having enough personnel available to adequately man a pipeline system, it is simply a question of to operate or not to operate. More efficient operation is difficult to prove, so it may be an intangible justification initially.

Computer equipment that is ordered for delivery this year to be received next year could be obsolete by the time it arrives, providing another hard problem for computer controller buyers.

Computer Control at Compressor Stations

In taking up the computer control at the compressor station it might be well to explain what is intended. Computer control at the station would enable the dispatcher to remotely set

The Author

John T. Manry III is presently coordinating engineer for Tennessee Gas Pipeline Co., a major operating division of Tennessee Gas Transmission Co. He received his bachelor of science degree in mechanical engineering from University of Texas in 1949. He joined Tennessee Gas Transmission Co. soon after graduation and has worked in the compressor, gas control, and general operating departments.

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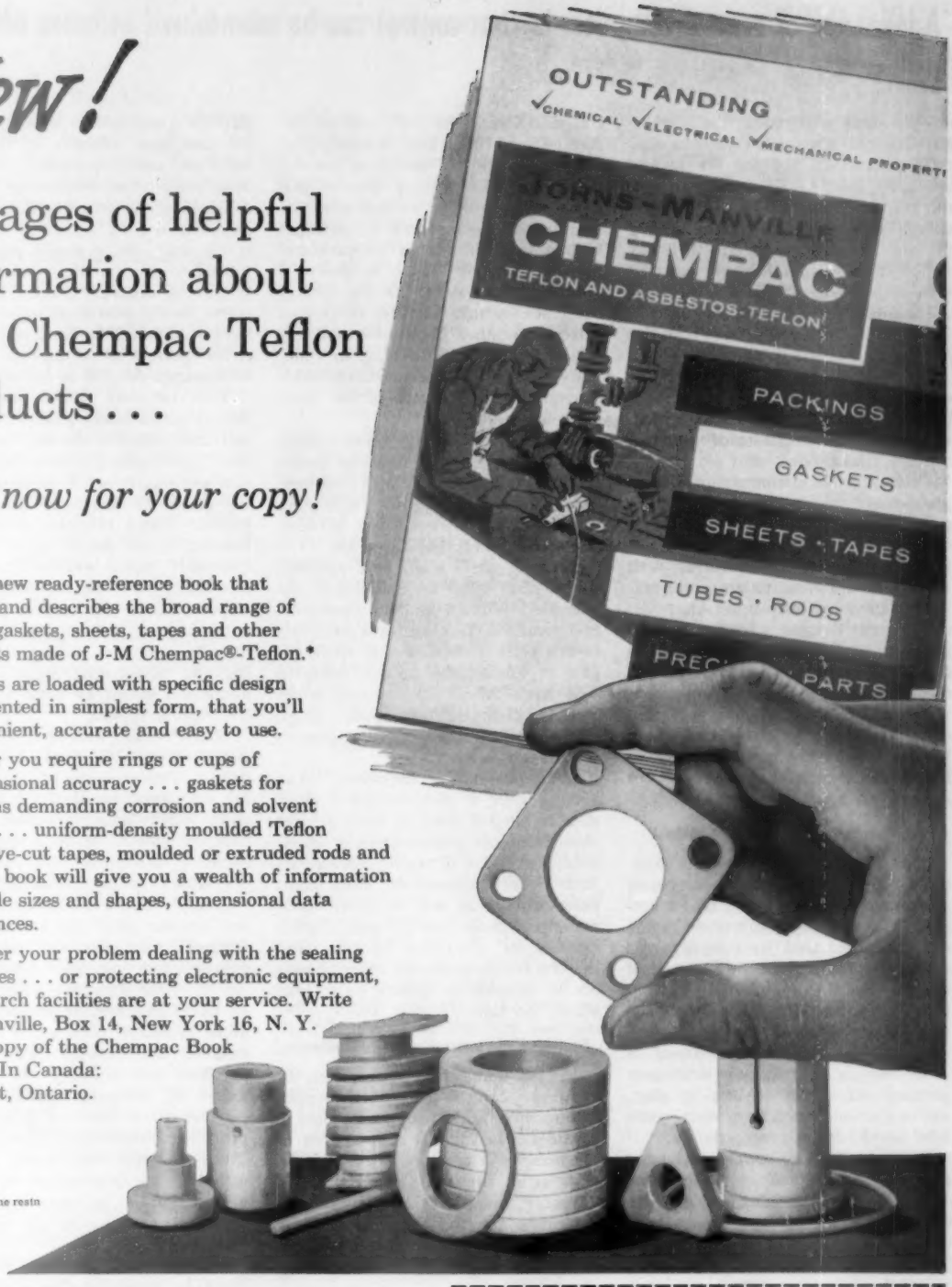

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the pressures required at the station, allowing the number of engines and their pocket settings for the proper operating load to be determined by the computer. In most cases the discharge pressure is the main setting for the station to operate by, but under special conditions the suction pressure may be the desired constant to maintain.

A minimum number of readings are needed in the dispatching office. These include station suction and discharge pressures, number of engines operating, valves open, fuel orifice-meter readings, and rate of gas flow through the station.

Control at the station requires computation of required per cent clearance of the reciprocating-compressor cylinders to load the engine to operating power. For initial startup with no differential pressure across the station, either the dispatcher may determine the number of units to start with, or all available engines may be used with an unloaded condition working up to the load using a minimum number of units. In contrast a human operator has to set the proper compressor-cylinder clearance-pocket combination using tables, load curves, or special graphs.

Advantages of Station Control

The main advantages of the computer controller at the compressor station stem from the fact that a versatile reciprocating-compressor engine could be operated in remote areas where it is difficult to find personnel to man three shifts. A definite pattern of starting the engines can be established to allow greater ease of scheduling preventive maintenance. In other words, instead of arbitrarily picking out which engines to start, the engine calculated to be overhauled first should be run accordingly.

There also is the reward of having the least number of units operating with continuous monitoring. By having the engines properly loaded, the fuel rate can be kept at the minimum since most fuel-consumption curves show the lowest unit fuel consumption at the rated load condition. Another advantage is that the dispatcher has direct control over the station without having to get into the details of the operation of the individual station.

Disadvantages of Station Control

Getting into the drawbacks of a station computer controller, the first consideration is the high cost of the computer and high cost of instrumentation, with highly technical maintenance required. Engine knocks and noises that forewarn operators of bearing trouble may not be detected without a multitude of temperature-pressure pickups. There is always a question of reliability of the control equipment which may be subject to extreme weather conditions and excessive vibrations. Building in reliability and ruggedness certainly adds a great deal to the cost of the computer controller.

Communications play quite a large part, in that contact must be maintained continuously, with definite provisions made to insure operation when contact has been lost between the station and the dispatcher. The security of the station is a problem if the plant is to be completely unattended. Without human operators, minor maintenance causes a reduction in deliveries if there are no spare engine or convenient storage fields to draw upon. Minor maintenance might include changing of spark plugs, blown-out valve gaskets, and broken compressor valves.

Reciprocating compressors that operate over a wide range of pressure conditions need to have a large number of compressor-cylinder clearance pockets. A dozen or more clearance pockets necessitate more computer storage as well as more automatic pocket openers. By using a small number of clearance pockets, and thereby saving computer space, it may not be possible to operate up to load all of the time.

Station Computer-Control Summary

In concluding the discussion on the computer control at the compressor station there are a couple of points to consider. The first is examination of the manpower situation which will be with us in the next 5 to 10 years. Secondly, manpower availability may determine the feasibility of the station computer which would lend itself to another level of control if the need arose.

The technology is here to do the job but the building in of reliability raises cost considerably. Specifications would have to include continuous operation for several thousand hours to be justifiable at all.

Central Computer at Main Office

Once it is determined how more efficient operation can be obtained through a continuous minute-by-minute computer analysis of the pressures and other operating conditions, then competitive enterprises have to consider any scheme that does a better job. The use of a central computer at the main office would provide information to remotely operate the system by ordering the correct pressures, flows, purchase volumes, and sales volumes. This concept can have either personnel or remote pickups to transmit data to a computer.

The computer would have to be turned on 24 hours a day, of course, and could feasibly do data processing and engineering problems during regular working hours. Information coming in to the computer via the dispatcher office may be conveniently handled using punch paper tape or computer input with a hard copy monitoring data on an electric typewriter. All of the station pressures, temperatures, and engine conditions may be combined to keep the station log and dispatching reports as one composite group of data stored for the regular reports.

Special sales transfers, emergency purchase cutoffs, and breakdowns would in most cases be entered into the computer by the dispatcher. A daily gas balance processed on the computer would make a much more accurate document for day-to-day operations by the dispatcher.

Assume that a mathematically correct simulation of the system is programed on the computer and all compressor and pipeline facilities are stored in the memory. After entering all sales commitments, including minimum pressures plus safety factor if desired, and desired deliveries, the purchase tap volumes are then selected by computer calculations according to an arbitrary priority or a prorated amount of all purchase taps. These amounts, of course, are subject to state allowables of gas removed from certain fields, and whether or not contracts have been exceeded.

With all of these data available, the computer should be able to solve operating compressor pressures required for the entire pipeline a hundred or more times and then pick the best solution. How close the chosen set of operating conditions is to optimum depends upon the size and speed of the computer, which may vary in price from a low of $1,000,000 up to $6,000,000 for the larger, complex network gas-transmission lines.

"Simple pipeline could use inexpensive computer costing less than $200,000."

These types of computers, however, can probably be leased since they would not directly control, and would only provide information for the dispatchers. Rentals would range from $30,000 to $150,000 per month.

Central Computer Advantages

The big advantage of the central computer is that control can be maintained in the main office. Maintenance of the computer would be easier handled in the central location rather than in many remote locations. Computer operators would be able to continuously recommend logic revisions to the simulation program to make it more efficiently lead to a closer optimization operation. If it is desirable to purchase a computer, a company would have the use of this type for 24 hours a day with only the computer maintenance cost to consider.

Central Computer Disadvantages

The usual advantages of renting computers for 40 hours a week are overridden when they are to be run 24 hours a day. Cost generally runs 40 to 50% of the prime-shift rental. As there are usually 40 hours a week in the prime shift, 128 hours at the reduced rate would be more than double the cost of a regular rent price. A minimum configuration of peripheral equipment to be used continuously could reduce the cost considerably.

Data input accuracy to the computer from the field is critical. Location of the computer has to be accessible to dispatching operations or some facility, such as a remote inquiry station, must be made available. Some of the same disadvantages as the station computer controller would be encountered here. These are, again, expensive instrumentation and the necessity of reliable communication facilities.

Central Computer Summary

Summarizing the concept of the central computer control, the following observations are made. Pipeline control, having conditions which are specified by the computer, offers a wide range of flexibility. The dispatcher in remotely setting pressure conditions from analysis of many conditions would be able to concentrate on special situations that arise, leaving the tedious time-consuming jobs of posting and manual calculations to the computer. A simple pipeline could use effectively a relatively inexpensive computer costing less than $200,000, but one with a complex network needs the large high-speed machine to aid in decision-making for pipeline operations.

Data input needs to have a high degree of development. An example of this would be conversion of gas-flow-meter analog data to digital readings. Information such as compressor-station pressure must be accurately transmitted to an on-line system computer controller.

Continuous monitoring of all gas flows, including keeping track of all gas purchased and gas sold, would be a feature of the computer's duties. The bookkeeping of the gas amounts removed or put into storage would be another. Pipeline pack on a continuous basis provides an extra margin of extended sales and during prolonged cold weather could be accurately handled before last-minute cutbacks are made. Whether information including degree-day data may be conveniently added, providing additional factors to regulate gas flows.

System Computer Advantages

Many advantages are available using this particular system. Efficient engine combination operation can assure the least number of units running at one time. It takes a computer to analyze the fuel and maintenance characteristics of several hundred compressor units. For instance, assume the total fuel of the pipeline consumption to be 100,000 M.c.f. per day and allow for a cost of 20 cents, which amounts to $20,000 per day. By operating the best fuel-saving combination of engines, a reasonable figure might amount to a 5% saving of fuel cost or $1,000 per day.

Likewise, by putting a dollar sign on the engine maintenance cost, assume a maintenance figure of $5,000,000 per year. The same 5% saving in units operating theoretically may be applied to maintenance. Therefore, 5% of $5,000,000 amounts to $250,000 per year. By going a step further, it is possible with enough accumulated data to run the most efficient engine combination from a maintenance standpoint, but it seems likely that a compromise between the fuel costs and maintenance costs would be made.

Also, the engines have different characteristics and likewise different deliverability ratings for reciprocating compressors and centrifugal compressors. Horsepower per million cubic feet of gas is a deliverability factor that varies widely with compression ratio, temperatures, and pressures in all compressors. Compressor-valve wastes influence the effective horsepower greatly. Pipelines operating at full capacity, or nearly full capacity, would of course have less need for computations involving picking the best engines to use, since they would all be running.

System Computer Disadvantages

A negative factor would be that a computer to control the whole pipeline system may not be available for any data processing. The feature of controlling simultaneously with data processing could be too costly. Also, computer reliability is necessary and the capacity must be very large in a complex system, and so it will be expensive. Pipelines having been in existence many years will have difficulty in installing remote equipment on old systems. Remote control of new pipeline stations may not be completely compatible with manually operated stations. In all likelihood the computers would have to be built to definite specifications and take several years to manufacture.

System Computer Summary

In summation, it seems highly plausible that as designs of pipelines become more accurate in anticipating actual operating conditions, the advantages of the system computer controller will outweigh the disadvantages. Operations to follow that close design will need the computer touch. This philosophy is becoming increasingly true in military as well as industrial applications.

As an example, a manually designed compressor station might be improved by manually operating the plant with deviations from design. A system which was manually designed could be far overdesigned or vice versa. Economics in competition dictate that facilities installed with close tolerances be operated that way. As a matter of fact, the latest computers are designed by computers and even when they are running, it takes a lesser computer to control its operations. A computer controller for a computer is what it amounts to.

Acknowledgments

The author wishes to acknowledge the helpful suggestions made by G. W. White and G. M. Fitzgerald.

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Humble attacks pollution at Baytown

PART 1 OF 2 PARTS

BY LARRY RESEN
Refining Editor

A MULTIPRONGED attack on air and stream contamination at Humble Oil & Refining Co.'s Baytown, Tex., refinery has resulted in marked improvement in contamination problems associated with plant-processing operations.

The all-inclusive program is still a continuing, growing project even though more than $6,000,000 has been spent on it during the past decade and the original goals have been surpassed (Table 1).

The plant . . . The refinery has a crude-oil-charge capacity of 283,900 bbl. per calendar day. Major processing facilities include five two-stage pipe stills, one propane deasphalter, three fluid catalytic cracking units, two platinum-catalyst reforming units, two liquid SO_2 extraction units, one catalytic polymerization unit, one alkylation plant, several hydrogen-treating units, and several light-ends units.

The lube-processing sequence includes deasphalting, dewaxing, and phenol extraction, plus associated operations such as Hydrofining, acid treating, and clay contacting. Many treating operations, such as acid treating, caustic washing, hypochlorite sweetening, and oxygen sweetening complete the complex processing picture.

Sewer systems . . . The refinery area is served by three main industrial sewer systems; east, central, and west. These sewers serve not only the proc-

ess area, but also drain a major portion of the 3,000-acre site. This system was laid out prior to the development of segregated "clean water" sewers which handle storm runoff, plus process water that does not come in contact with oil, and "dirty-water" sewers that handle water containing spent chemicals or oil or both.

Storm water passes through the same system that handles process water and complicates the design of oil-recovery systems. Storm flow can be as much as 10-30 times the normal flow. Unfortunately it does not appear feasible to set up a segregated system throughout the refinery at this late date, although design work is well along on a clean-water sewer that will skirt the refinery and will carry much of the storm runoff water which currently is carried off by the process sewers.

Flow reduced . . . Normal flow through the main system was approximately 44 million gallons per day at the start of the improvement program. This has been reduced to approximately 17 million gallons per day by elimination of once-through salt water and additional use of cooling towers. Upstream from the point where the west trunk sewer enters a covered preseparation flume, an average of 1 million gallons per day of ship's ballast is added to the 6 million gallons of process water flowing in this sewer.

Another preseparation flume (Separator 13) collects separable oil from the 5 million gallons flowing in the central trunk sewer. Another preseparation flume is under construction on the east trunk sewer which handles approximately 5 million gallons of process water per day. These flumes provide an average residence time of 10 minutes which permits the major portion of the free oil to rise to the surface where it is skimmed by floating skimmers.

Underflow baffles in the outlet end of the preseparation flumes serve to trap the stable oil-water emulsions. To prevent these emulsions from reaching the main oil-water separator, facilities are included to withdraw the emulsion layer from the preseparation flumes and discharge it to heat settling tanks. These preseparators were built as part of the effluent improvement program and were justified on the basis of preventing evaporation losses on the main oil-water separator.

Downstream from the main separator about 28 million gallons of cool, oxygen-rich water from a nearby bay is pumped into the outfall canal to insure that the effluent discharged into the Houston Ship Channel is cool enough to prevent loss of marine life from thermal shock or oxygen deficiency.

Oil recovery . . . Free oil skimmed from the preseparation flumes contains only 1 to 2% oil and is pumped directly to a 55,000-bbl. cold settling tank where the moisture content is reduced to below 0.5%. A portion of the 2,000 bbl. per day of oil that enters the sewer system reaches the separators in the form of a relatively stable emulsion. This emulsion contains 40 to 60% water and is stabilized by the presence of 2 to 4% solids. A portion of the emulsion is removed from the preseparation flumes through the emulsion removal system but the remainder is discharged into the main separator.

The main oil-water separator provides an average residence time of 1 to 2 hours which permits the emulsion to rise to the surface and heavier-than-water solids to settle to the bottom. The emulsion is removed from

TABLE 1—AVERAGE INSPECTION ON REFINERY EFFLUENT

	Start	1950		1952		1954		1956		1958	
Quality—	1948	1	2	1	2	1	2	1	2	1	2
Temperature, °F.	125	85	97	84	86	79	83	79	82	78.2	82.1
Oil content, p.p.m.	700	133	140	122	124	49	53	37	20	40.5	24.5
Dissolved oxygen, p.p.m.	—6.0	2.5	2.4	2.0	1.7	4.8	4.1	4.6	5.1	5.3	4.4
pH	3.0-11.0	8.4	7.2	8.7	8.4	9.1	9.0	8.5	8.5	8.2	8.1
Turbidity, p.p.m.	500	385	289	237	203	129	126	106	79	120	93.8
Chem. oxygen demand, p.p.m.	65	56	22	35	34	39	32	29	27	14	15
Suspended solids, p.p.m.	190	154	69	160	74	59	66	76	66	69	59
Sulfides, p.p.m.	20	*10	*10	4.8	3.5	2.4	1.3	0.7	0.5	0.2	0.1
Bio. oxygen demand, p.p.m.	200	217	154	140	113	151	101	121	154	60	53
Over-all improvement rating	0	69.9	74.1	79.4	86.6	89.7	94.0	98.5	96.1	112.2	111.7

*Estimated.

FISH TAKEN from the Houston Ship Channel, left, on a routine basis, are examined in the laboratory, right, as a check on quality of channel water.

the surface by a flight scraper and is transferred to cone-bottom heat settling tanks. Dry oil separated in the course of the heat settling step is transferred to the cold settling tank prior to being routed to a rerun pipe still.

Stable emulsions from the heat settling operation is transferred to the effluent filtration unit where the emulsion is resolved by removing the solids in a precoat filter operation and then subjecting the filtrate to heat settling. Oil-coated solids removed from the separators are pumped to a settling basin in a slurry containing 4 to 6% solids. These settle rapidly and the water which overflows to the east sewer is of good quality.

Sour-water stripping . . . A collection system has been installed to route all process waters containing H_2S to a sour-water stripping unit. Here the water is first acidified to a pH of 4.0 and then stripped with natural gas in a packed tower. This removes 99% plus of the H_2S present in the incoming stream.

Spent chemicals treatment . . . Spent chemicals from refinery treating operations are among the most potent stream contaminants. It is necessary to neutralize and clarify all spent-chemical streams that are too dilute to economically recover for reuse or for sale. A segregated sewer system has been installed to route approximately 1.5 million gallons per day of water containing spent chemicals to these facilities.

These are principally wash waters used to remove caustic or acid following caustic-washing or acid-treating operations. This predominantly alkaline stream is acidified to a pH of 1.5 to 2.0 and sent to an impounding basin to permit removal of "acid oils" by gravity settling and skimming. Acidic water from the bottom of the impounding basin is neutralized with caustic and lime, and sodium aluminate is added as a flocculation aid.

Sludge from treating boiler water is also added as a weighting agent. This mixture is then pumped to a coagulation basin where the flocculant material settles to the bottom and the clarified water overflows to the west sewer. The sludge from this flocculation operation is pumped to a large settling basin on the north side of the refinery.

Contamination Work

Humble's approach to the problem of preventing contamination has been fourfold:

1. Attack at the source—This is the best approach but not always the easiest or the most practical. Where feasible, modifications or additions have been made to equipment and processes to eliminate the production or release of contaminants. In some cases sales outlets have been developed for disposing of such materials as spent caustics containing sulfides or phenols. Segregation of these wastes was necessary to meet purchaser requirements.

2. Improved processes—This actually ties in with the attack at the source since a new process can result in retirement of an existing one which by its nature is a source of contaminant. For example, Hydrofining processes eliminated several acid-treating units which are inherently producers of serious contamination problems.

Construction of new process units is a long-range approach which has decided benefits in the long haul. Humble's current policy with regard to new processes is that self-contained facilities for contamination prevention must be included in the design and conomics of the process.

3. Installation of special equipment—In some cases where similar wastes are produced at a multiplicity of locations, economics dictate that common treating facilities be installed. Special equipment such as the effluent filtra-

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tion unit and the sour-water stripper, were installed to handle wastes from a large number of units.

Such installations together with improvements to oil-water separators which remove oil from the entire refinery effluent played a significant part in the success of the program.

4. Affix responsibility—The best of facilities lose their effectiveness without the cooperation of operating personnel to insure their maximum utilization. Humble uses a full-time staff to monitor its contamination-prevention program. An oil-loss coordinator is responsible for maintaining high efficiency on all equipment involved in air or water contamination control.

An effluent committee is responsible for long-range planning. This committee works with refinery planning and engineering groups to insure that adequate waste-disposal facilities are included in new unit design.

Humble's Effluent-Control Program

Probably the best way to describe Humble's program is to break down the activities into water and air divisions.

Water . . . Initially the company set up a long-range-planning committee to outline effluent-quality goals to be achieved in the over-all program. The purpose here was to define the scope of activities to be covered and to pinpoint the attack at the most critical areas. Desired effluent-water-quality goals were established.

A 5-year stepwise construction program was set up to provide the facilities considered necessary to achieve the effluent quality goals. The stepwise program allowed evaluation of the various steps and also of the effect of new process units. As the project unfolded, some of the items on the original list were canceled, some postponed, and many others added.

Expenditures credited to the program did not include outlays for facilities such as electrical coalescers, Hydrofining units, or clay-treating units. These did effect marked reductions in the quantity of spent chemicals reaching the sewer system, but since they involved economic returns they were not included in the total effluent-improvement-program expenditures.

Several major steps were taken to implement this program:

1. Sanitary sewer system and treating plant—$330,000. A sanitary sewage-gathering system and a 500,000-gal. per day treating plant were placed in operation in 1949 and expanded in 1951. The treating plant consists of a lift station, a combination primary settling and digestion tank, trickling filter, final settler, chlorination chamber, and sludge-drying beds.

Operation has been very satisfactory, and it has been found that oil infiltration into the system is not a problem since moderate quantities can be tolerated. On the average, biochemical oxygen demand (BOD) of the sewage is reduced from 200-250 p.p.m., to 10-20 p.p.m.

2. Eliminate the use of salt water for cooling—$240,000. The use of large quantities of once-through salt water for cooling contributed two problems. First, the sewer separator system was overloaded with hot, oxygen-deficient water. The temperature of the effluent often rose as high as 130° F. during the summer months. Secondly, the pH of the water in the sewer system often became high enough to precipitate magnesium and calcium salts from the salt water. This precipitate or floc tended to stabilize emulsions and hinder the gravity separation of oil and sediment in the oil-water separator.

Installation of cooling towers and recirculated water systems made it possible to eliminate the once-through salt water. This reduced the average flow from 45 million to 24 million gallons per day. Removal of the hot salt water from the system reduced the temperature of the refinery effluent by 25° F. during the summer months.

3. Pumpover system—$76,000. A

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pump station was installed in 1949 on a bay adjacent to the outfall canal, to pump 28 million gallons of cool, oxygen-saturated water from the bay into the outfall canal. This water not only cools the effluent below the desired goal of 100° F. maximum set at the start of the program, but also insures that the dissolved oxygen content of the effluent is high enough to sustain marine life.

An unexpected benefit was obtained since under certain conditions the agitation resulting from discharge of the bay water stream into the outfall canal causes any remaining suspended solids to be floated to the surface in the form of a froth. The recurrent formation of this froth resulted in the installation of a permanent skimmer in 1956 to skim it from the surface of the outfall canal and discharge it into a settling basin adjacent to the canal.

4. Spent-caustic-collection system —$661,000 (plus $150,000 in 1957). Caustic consumption has risen markedly in the Baytown refinery from a 26-million-pound per year level at the beginning of the program to a maximum of 47 million pounds in 1954. Disposal of the spent caustics is a major problem since most of the streams contain emulsion-forming and oxygen-consuming compounds. For many years Humble has collected sulfide-bearing spent caustic for sale to consumers, and an early expenditure was for additional facilities to collect streams which could be routed to sales.

Concentration capacity for sulfide spent caustic was also increased by installation of a single-stage evaporator capable of handling all available streams. An old concentrator without fume-burning facilities was dismantled. The gases plus the steam evolved from the new concentrator are burned in a fume burner and discharged to the air through a 150-ft.-high stack to minimize air contamination.

During most of 1955, production of the sulfide-bearing caustic outstripped sales and inventory reached a critical point near the end of the year. It became necessary to acidify the material to a pH of 1.0-1.5 with spent alkylation acid and burn the liberated H_2S in a fume furnace. Acidification is carried out in an existing 12 by 40-ft. brick-lined horizontal drum which was connected to a fume furnace with steam as the stripping medium.

Acidification and stripping reduced the sulfide content from 60,000 p.p.m. to below 5 p.p.m. The acidic effluent was then neutralized and clarified. Cost of the alkylation acid for the operation was around 10 cents per barrel.

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5. Collection and disposition of spent chemical streams—$400,000. Additional facilities were installed in 1956, for collecting and disposing of the spent chemical streams. The new facilities include a system for segregating spent caustics containing organic acids since a market was developed for those caustics. Where streams are too dilute for recovery for reuse or sale they are sent to the effluent flocculation plant for neutralization and clarification.

6. Caustic regeneration—$700,000. A great deal of study has been given to the regeneration and reuse of spent caustic. Where caustics are used primarily for mercaptan removal, it is possible to regenerate by blowing with air at elevated temperatures converting mercaptans to disulfides. With heavier mercaptans this can be done at atmospheric pressure. With methyl and ethyl mercaptans operations at 50 psig. or higher gives better results. The disulfide formed separates from the caustic on settling.

In most cases the regenerated caustic can be returned directly to use. In some operations, particularly those involving petrochemical feed stocks, little or no sulfur can be tolerated and it is necessary to scrub all remaining disulfides from the regenerated caustic before use. A caustic regenerator operating at 50 psig. was installed to replace an operation conducted in open tanks without benefit of a fume furnace.

Fumes from the new facilities are burned in a fume furnace. Care is taken to avoid any sizable amount of air stripping of the caustic since this would divert disulfide to the fume burner and result in an air contamination problem.

7. Effluent filtration and flocculation unit– $1,439,000. This is the biggest single outlay in Humble's effluent-improvement program. It consists of a flocculation section for clarifying nonsulfide-bearing wastes and a precoat filtration section for resolving oil-water emulsions that are stabilized by the presence of solids.

The flocculation section takes care of 1 to 1.5 million gallons per day of waste waters produced as a result of acid-treating and caustic-washing operations. These waters have an adverse effect on the effluent and it is not economically feasible to concentrate the dilute solutions for sale to other industries.

Treating sequence in this section consists of the following steps: (1) Acidification to a pH of 1.5-2.0 with spent alky acid to liberate organic acids, (2) settling by gravity in an earthen impounding basin to remove organic acids, (3) neutralization with a combination of lime and caustic to a pH of 7-8 to produce floc, and (4) addition of sodium aluminate and boiler water treating sludge to aid flocculation and removal of floc in clarification operation.

Clarified water from this operation contains 30 to 50 p.p.m. suspended solids and is discharged to the west sewer system. Floc is withdrawn from the bottom of the 40-ft.-diameter clarifier as a 5 to 10% slurry at 20 to 30-minute intervals, and is pumped to a settling basin. Operating costs for the floc section are approximately 25 cents per thousand gallons of water treated.

The filtration section consists of three 8 by 10-ft. rotary vacuum precoat filters and associated equipment. An 18-in. trough-type conveyer removes filter cake from the building and dumps it into dump trucks. The clippings are removed and utilized by a contractor.

8. Sour-water stripper $355,000. A collection system was installed in 1952 to route water containing H_2S from essentially all distillation and cracking operations to a sour-water stripping unit. This system has been expanded to include water from Hydrofining and desulfurization operations. From 300,000 to 500,000 gal. per day of water containing approximately 3,000 p.p.m. of sulfide is pumped from the various units to a surge and mixing tank where it is acidified to a pH of 6.0-6.5

This material is then stripped with 2.0-2,5 M.M.c.f.d. of natural gas in a 36 by 4-ft. packed tower. The tower is operated at 50 psig. to permit discharge of the exit gas to the fuel system. Stripped water containing less than 50 p.p.m. is discharged to the sewer.

High corrosion rates in the gunite-lined carbon-steel stripping tower have led to installation of a 44 by 4.5-ft. alloy-clad stripping tower equipped with 20 perforated plates. Spare pumps have been installed at all collection points and appropriate corrosion-resistant material is used for all pipe in contact with sour water.

These steps plus repair of the old tower for use in standby service have made it possible to operate the stripping facilities essentially 100% of the time. The alloy tower also permits reduction of the pH of the incoming sour water to approximately 4.5. This gives much greater stripping efficiency and the sulfide content of the effluent water is currently below 10 p.p.m. most of the time and is often 1 or 2 p.p.m.

Part 2 of this article will appear in the next issue of the Journal.

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If you're familiar with the one-step Houdry Dehydrogenation Process, you know the source of profit for a large share of this country's butadiene production capacity. Since the major expansion of the synthetic rubber industry began in 1955, more than 300,000 ton/yr of new capacity has been installed by Houdry licensees using this process for transforming butane to butadiene.

Don't get the idea though, that you have to make synthetic rubber to enjoy the advantages of the Houdry Dehydrogenation Process. It is also highly efficient for transforming butane to butenes, isobutane to isobutene, and other light hydrocarbons to mono- and di-olefins.

Simple . . . flexible . . . profitable. That's the Houdry Dehydrogenation Process. And it has these three very important characteristics because Houdry people designed it that way, and made it deliver.

They can do the same for you.

*

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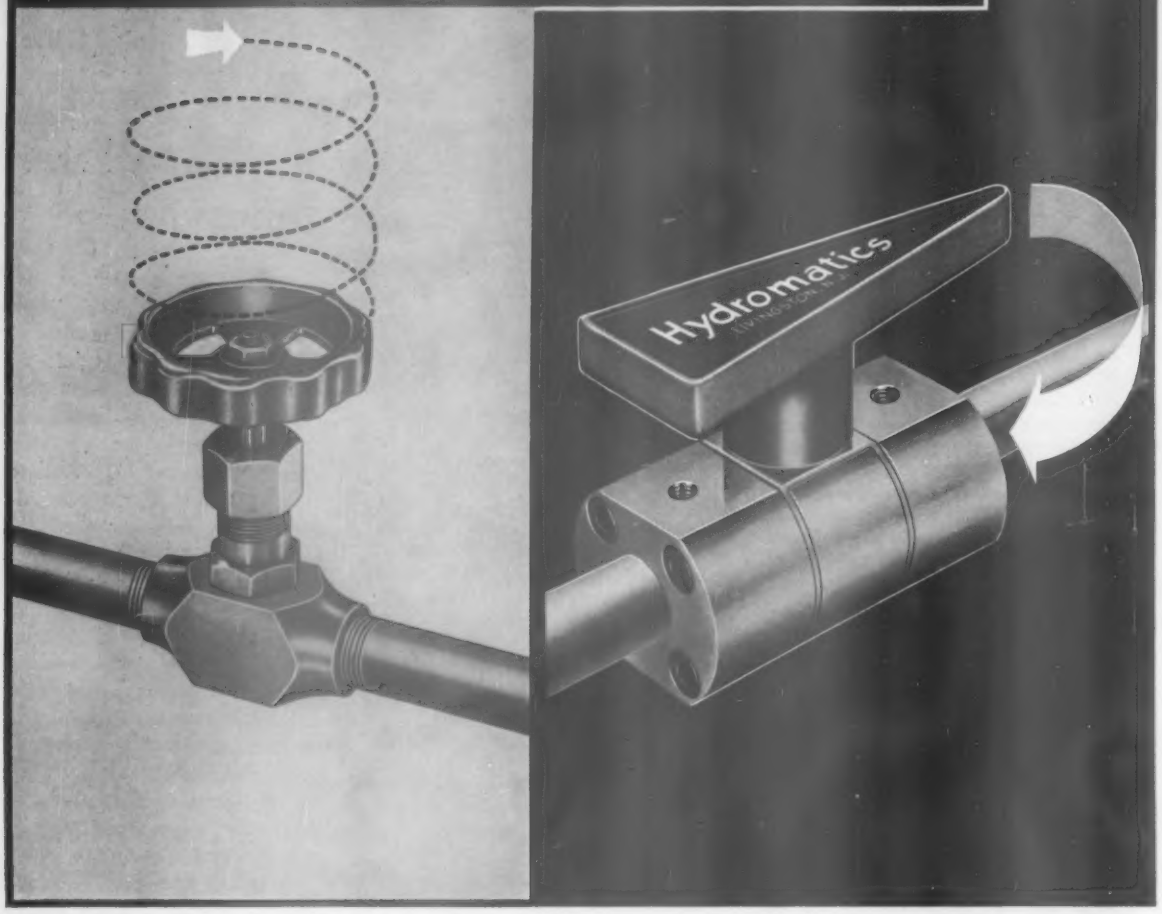
PROCESSES

HOUDRY PROCESS CORPORATION

1528 Walnut Street, Philadelphia 2, Pa.

*Houdry means Progress . . . through Catalysis

FLO-BALL 715 makes needle valves obsolete



WHICH VALVE CLOSES FASTER?

Unlike the many turns required to operate a needle valve, the Hydromatics ***FLO•BALL 715***, shown on the right, closes instantly with a mere ¼ turn . . . **positive action** at flow pressures up to 3,000 psi with just a 4 inch-pound torque! And the arrow-shaped handle shows both open and closed positions at a glance. Exclusive ***FLO•BALL*** straight-thru design has 100% flow efficiency—more than double the flow of needle valves.

Ideal for leakproof control of air, vacuum, steam, water, fuels, oils, kerosene, alcohol, etc., the ***FLO•BALL*** features zero leakage, universal mounting, removable flanges, and all stainless steel construction.

Write today for a complete catalog describing this valve and others for corrosive and cryogenic media. Also special designs for throttling flow control.

The *FLO•BALL* costs no more than old fashioned screw-type valves!

Hydromatics, Inc.

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FLO-BALL

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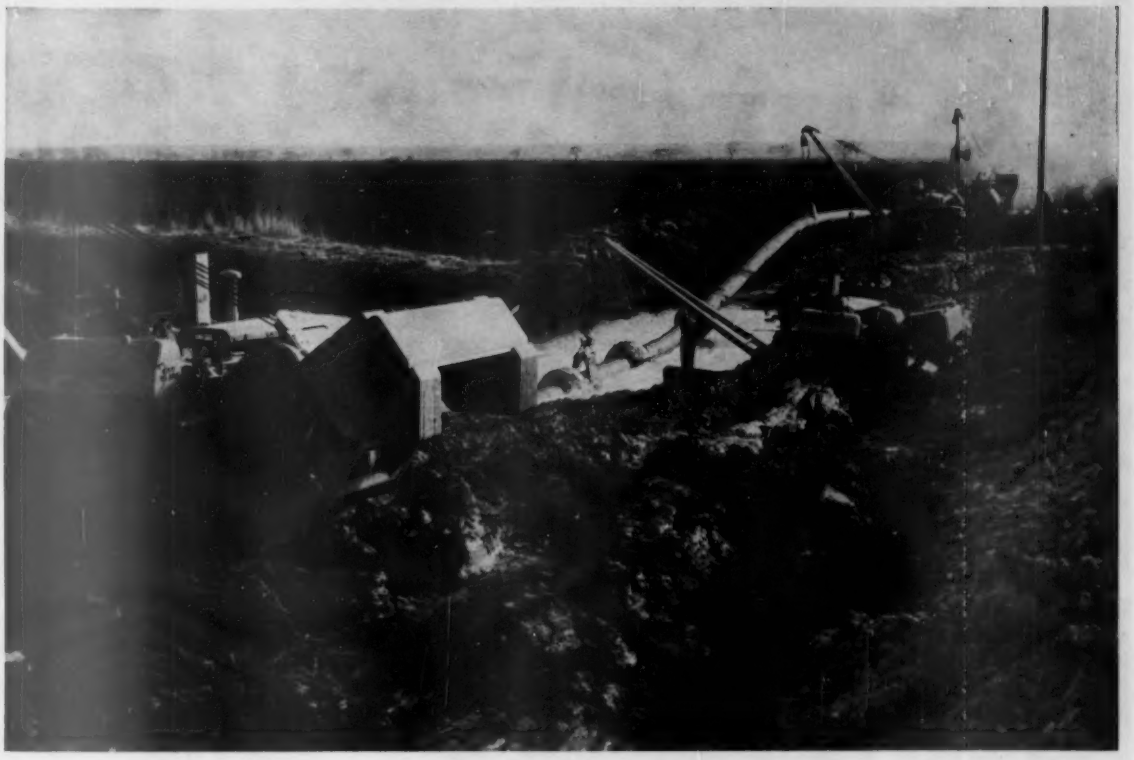
Exceptional engineering employment opportunities—write today!

PIPELINING



This Iowa-Illinois line was laid through 9-ft.-deep mire as . . .

Pipeliners fight Mississippi mud

TACK RIGS mounted on tractors provided maneuverability needed in the mud to keep pipe-gang operations from bogging down. Pipe gang laid 8,000 ft. per day in good weather.

ONLY the mudders found the going to their liking during a recent phase of operations on Michigan-Wisconsin Pipe Line Co.'s looping program in Iowa and Illinois.

Michigan-Wisconsin let contracts early this year to R. H. Fulton & Co., Panama-Williams Corp., and Somerville Construction to build 347 miles of 24-in. o.d. by .312-12. wall pipe along its present system in Missouri, Kansas, Iowa, Illinois, and Michigan.

Fulton had five spreads in Kansas and Missouri laying 220 miles in six loops. Somerville had a spread in Michigan.

For Panama-Williams, whose operations are covered here, two spreads in Iowa worked on 42.7 miles between Lineville and Centerville and 39.8 miles between Mt. Pleasant and Oakville. A third, in Illinois, laid 41.7 miles between New Windsor and Princeton.

This electronic computer can help optimize your marketing, production and equipment efficiency!

Royal Precision

LGP-30

World's largest-selling engineering and scientific computer

The Royal Precision LGP-30, marketed by Royal McBee, is today helping create new concepts of operating efficiency in many processing industry applications.

The LGP-30 is programmed and operated by the engineer himself to cut through the maze of mathematical computations demanded for peak-level operations. Some examples of the many tasks this machine is now performing are: simple selection of the severity level of the catalytic reformer; most profitable combination of operations in the production, sale and purchase of gasoline, butane, naphtha; computation of heat balances; vapor-liquid equilibria; process simulation; design of heat exchangers, columns and reactors; crude oil evaluation; product yield structure; blending; economic payout determinations.

The LGP-30 is low in cost—about the price of a good engineer—and is simple to program and operate. Its 4096-word memory is comparable to computers many times its size and cost. User-engineers develop a man-machine relationship to the point where the machine becomes an extension of their own thinking capacity. Bolder, more creative engineering almost always results.

No site preparation is necessary. Plug the LGP-30 into the nearest standard outlet and it is ready to go to work. Customers have access to an extensive library of engineering programs and sub-routines, plus the opportunity to join an active users organization.

Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. LGP-30 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For complete information on the LGP-30, write ROYAL McBEE CORPORATION, data processing division, Port Chester, N. Y.

CLAM CLEANS out the ditch after cave-in which occurred repeatedly in bottom land with high water table.

Official kickoff date for Panama-Williams was April 1. The job was completed in approximately 30 working days. The Mt. Pleasant portion of the contract was typical: rolling country where the soil was primarily clay.

Clearing was accomplished by three D7 crawlers with straight dozer blades. No particular clearing problems were met; 2 to 4-ft. sidehill cuts were made in some places to cut down the rolling terrain, while power saws razed brush and trees along the 75-ft. right of way.

River-Bottom Construction

The Mt. Pleasant-Oakville loop included about 32,000 ft. of Mississippi River bottom land. The problems of pipelining in this wet, sandy loam were compounded by the fact that the loop also parallels the Cedar River, only a mile distant, for several miles. Trenches filled quickly with ground and rain water, requiring much pumping with two 6-in. water pumps before work could progress.

Trench dimensions—38 in. wide and 54 in. deep, enough to put the pipe 30 in. below existing terrain and structures—had to be adapted to the river-bottom soil. The trench was widened to a 1½:1 slope through use of wings on the ditchers. Two backholes, two ditchers, and a D6 tractor handled ditching. The backholes cut through the small amount of rock on the job.

Heavy spring rains saturated the river-bottom land and the combination of rain and bottom land caused many cave-ins behind the ditchers. In several cases doping and lowering had to be delayed until a clam could excavate the cave-ins. On the day before the rains came, Panama-Williams laid 201 of the 40-ft. random joints in the river bottom.

At one portion of the loop near Oakville, the line had to go under a drainage canal about 12-ft. wide. Some of the pipe in this area was lowered, and in anticipation of rain, backfilled in spots. The backfilling

HOT ASPHALT, glass, and felt are applied to 24-in. pipe before lowering directly into the ditch behind the dope machine.

DURA SEAL

means VERSATILITY

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Dura Seal is the most extensive line of mechanical seals offered to industry today . . . meeting a wider range of pressures, temperatures and liquids.

Dura Seal is backed by 25 years of experience in the successful sealing of corrosive, volatile and abrasive conditions.

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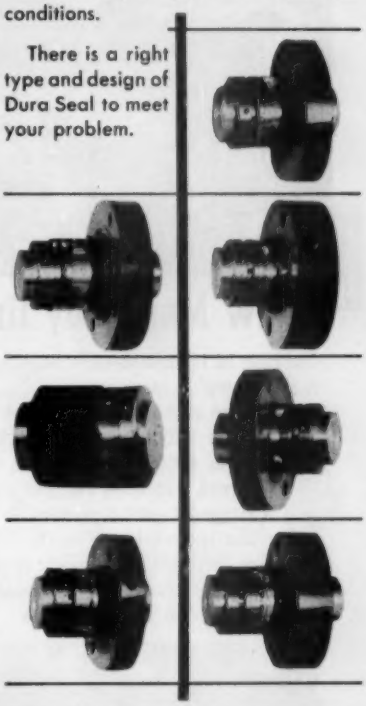

For further details, write for free copy of Catalog No. 4800G

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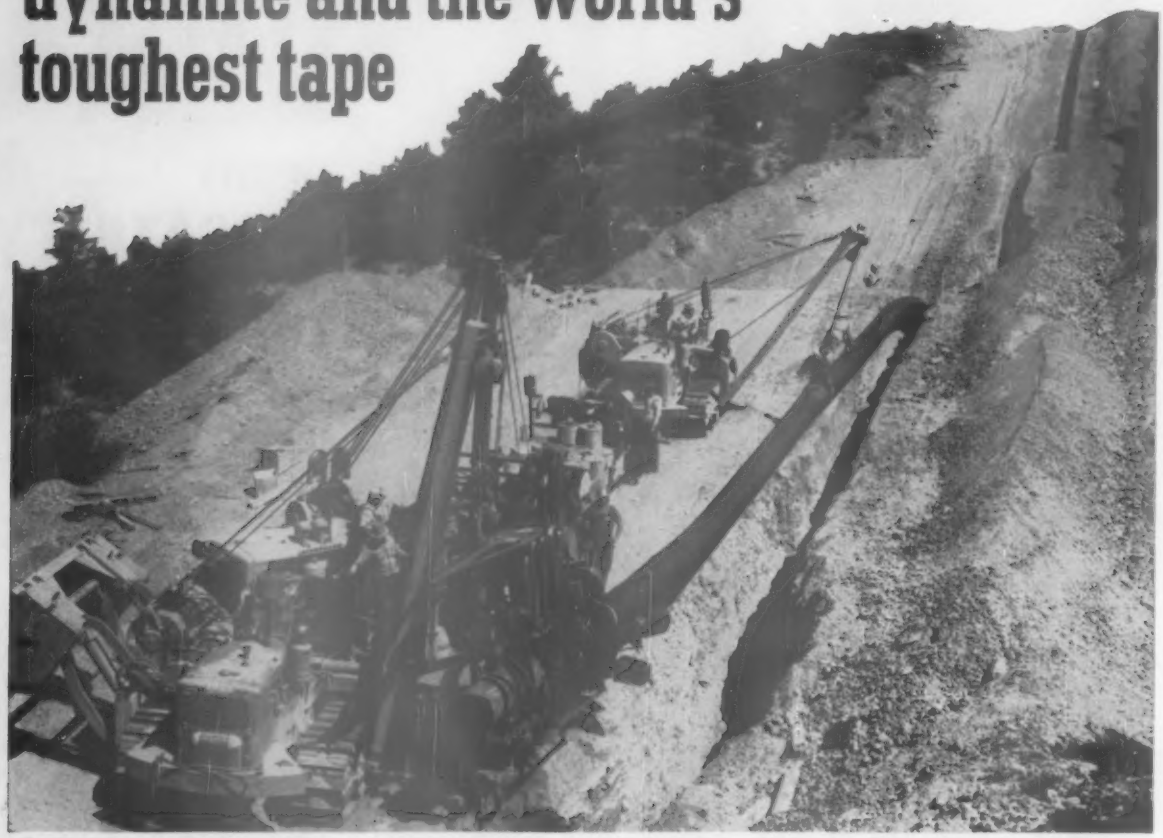
KALAMAZOO, MICHIGAN

Jobs this rough need mountain climbers, dynamite and the world's toughest tape



New Mandalay line protected by Polyken Extra-Strength #960

Putting in Richfield Oil's Mandalay Line was as mean a job as we've ever seen.

The line runs from sea level to points up to 8,300 feet in the mountains of Southern California, with grades over 40%. In places the trench was blasted out of solid rock. It took rugged crews to put the line in and a rugged tape to protect it.

On the recent big Florida Line and other lines in America, on lines in Canada and in Iran, Polyken has proven itself the most practical and economical protection you can put on a pipe.

Polyken tape pays off in performance—and in the currency of less men, less equipment, greater efficiency, more footage per day during construction. With tensioned-spindle equipment, pipe is cleaned, wrapped and over wrapped in one factory-smooth operation. Tape's ready. No primer, no drying or cooling, no fumes or fire hazard—none of those hot-dope problems.

Before you plan your next job, we'd like to tell you more about Polyken Extra-Strength #960. Call the Polyken distributor nearest you, or write Polyken, 309 West Jackson Blvd., Chicago 6, Illinois.

Polyken Tapes can be applied swiftly, easily, effectively, even under extreme conditions. This mountain-country coating went on with flat-country simplicity. That's why more contractors and pipeline managers are specifying Polyken.

THE MODERN WAY

Polyken®

EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

proved insufficient and the line floated up at several locations. Trenches then had to be reopened and the pipe relowered. In order to place the pipe under the drainage canal, four sets of concrete weights, each weighing about 5,300 lb., were bolted around the line at 15-ft. intervals.

One of Panama-Williams' three new turbocharged Caterpillar No. 583 Pipelayers was forced to operate in 8 to 10 ft. of mud that dammed the drainage canal. Then the 583's lowered the weighted pipe into the canal bed. The operators and foremen said the new pipelayers, used for the first time this spring, "more than filled the bill." Operators did not have to grease the lifetime-lubricated rollers in the deep-abrasive mud.

Maximum bends permitted by the contract were 19.5°.

Panama-Williams pipe gang had two crawler tractor-mounted tack rigs whose maneuverability proved valuable in the extremely muddy conditions.

Doping and Lowering in

The dope and lowering-in crews made 4,500 ft. a day in the bottom lands and 8,500 ft. a day once the spread hit open country. The cleaning-and-priming machine was cradled by a 583 that also pulled a sled of materials. Usually, two smaller machines are used for the operations.

Behind this team, 583's also were used to cradle the line and the dope machine for applying a 3/32-in. asphalt coating, glass wrap, and felt. The finished line dropped directly into the ditch. An HD20 sideboom tractor handled catchoff duties.

Tie-ins which normally require 30 minutes dragged out for an entire day at times because of the mud. Principal equipment on this gang included a clam and three new turbocharged 572 pipelayers introduced this spring.

Subcontractors and Personnel

Stringing on the Mt. Pleasant project was subcontracted to Parkhill Trucking Co., Tulsa. Horizontal Holes, Inc., Houston, had the subcontract for 17 borings for cased crossings.

Curt Vaughan, Ford-Bacon-Davis Construction Corp., was chief inspector. General supervisor of the three Panama-Williams jobs was W. H. (Cooney) Shiflett. Blackie Woodruff ran the Centerville job, M. E. Sutton the New Windsor job, and Red Wylie the Mt. Pleasant job.

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COMPRESS
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LIQUID LEVEL GAGES

Designed with exclusive features for range of pressures, temperatures, corrosive conditions or other specific requirements.

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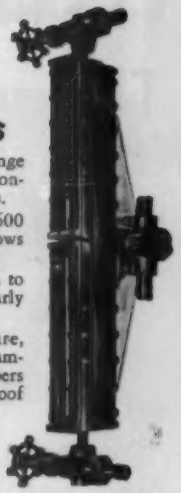
- **TRANSPARENT** — 4 pressure groups to 10,000 psig. Lengths to 12 ft. Clearly shows color, density on media.
- **SPECIAL SERVICE** — High pressure, Frost-Proof, Heating Tube and Chamber, Welding Pad, Large Chambers and Inclined Gages, Explosion-Proof Illuminator.



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Exclusive "floating shank" saves on installation, eliminates strains common to forced installations.

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Hydraulic, air and steam operated Penberthy ejectors (jet pumps, eductors, exhausters and syphons) simplify handling of fluids, vapors, gases and "hot" materials. In a variety of standard and special designs and materials.

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SUMP PUMPS

Automatic, electric, explosion-proof, submersible and standard types in 8 models, 20 sizes.

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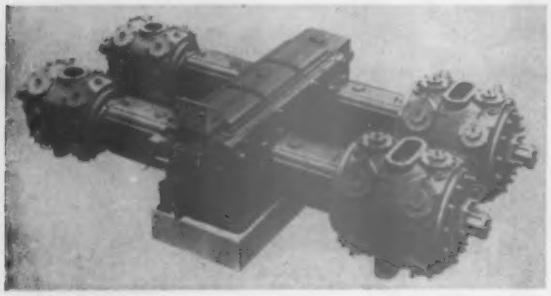
- CYCLING JET PUMPS
- LIQUID LEVEL GAGES
- GAGE VALVES
- SUMP PUMPS

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



New compressor for process plants

. . . just disclosed uses rugged, extra-heavy construction for the crankcase, crankshaft, and all running gear. The Model CJA compressor is a balanced-opposed type. Stroke length is 11 in.

The machine is built in models with two, four, or six cylinders and with ratings from 400 to 1,759 b.hp. Rated speed is 450 r.p.m. Drive can be by electric motor or other prime movers.

According to the manufacturer, the compressor is suited for high operating pressures and high differential pressures. It can be equipped with a variety of compressor cylinders to handle pressures from vacuum to 35,000 psi. SOURCE: **Clark Bros. Co., Dept. OGJ, Olean, N. Y.**

Counter speeds chart integration

. . . as much as 40% as compared with present methods of flow-chart integration. The Electronaflo counter, the maker claims, eliminates completely all errors due to transposition of numbers and incorrect substraction while integrating circular flow charts.

Easily adapted to present integrators, the electronic counter automatically registers on counter tubes the number presently recorded as the mechanical counter difference while the operator follows the chart lines on the integrator. At the end of the chart rotation, the operator can easily read the total count. The total count can be printed on the chart by slipping the chart into the printing slot on the counter.

The counter permits counting and totalizing from less than 1 to about 3,500 impulses a second. Weighing about 25 lb., the counter has a cast-aluminum case 10 in. high, 11 in. wide, and 17 in. deep. Source: **Flow Measurement Co., Inc., Dept. OGJ, Daniel Building, Tulsa.**

●

New equipment for slim-hole drilling

. . . and production has been developed. The upper part of the slim-hole well hookup on the equipment is a tee type of duplex stuffing box for 4¼ or 1½-in. tubing. The combination tee and stuffing box has a female thread and screws directly onto the tubing. This eliminates one threaded connection and results in a considerably shorter hookup than with older equipment.

The lower part of the slim-hole hookup is a tubing head with a one-piece body and 2-in. side outlets. The slips are hinged. Source: **Hercules Tool Co., Dept. OGJ, Box 286, Tulsa.**

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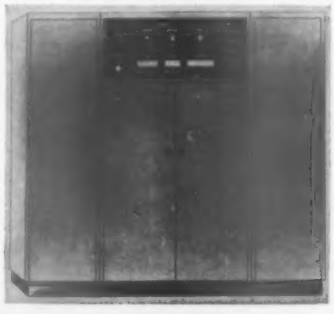

Data-processor with plug-in units

. . . now being produced is designed to perform a variety of functions. The Kybernetics Series 2000 system utilizes four basic units, plus-in housings,

Want more facts about equipment or copies of product literature described in this issue?

Send this **Showcase Coupon**

to manufacturer at address shown in bold type after each item.

Product name, Model no., literature title or number:.....

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Described in OIL AND GAS JOURNAL - Issue of **October 5, 1959**

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To provide this guarantee of prompt service on mechanical and electrical equipment, A-C offers its petro-chemical customers a whole mapful of personnel and facilities. They include:

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Matching this service is a tremendous scope of industry-designed equipment from one source. Ask your A-C representative about the last word in product designs, all proven by research and application, all built for outstanding quality control. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Products for Petro-Chemicals: Electrical Generation, Distribution and Utilization Equipment; Pumps, Compressors, Motors and Control; *Texrope* Drive Equipment; Processing Machinery (mills, kilns, screens, etc.); Water Conditioning Systems, plus Materials Handling Equipment.

Texrope is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-5915

New Equipment

and a pin-board arrangement for function programing.

The equipment includes an electronic scanner that can continuously monitor such variables as temperature, flow, and pressure and record them on demand or at specific intervals. It can also monitor for off-normal conditions and sound an alarm when preset high or low safety points are exceeded.

The basic logging unit, which records process data on a log sheet or other output devices, can be expanded to provide for scanning more points and to perform other operations.

Pin-board programing gives the system considerable flexibility. SOURCE: **Controls Div., Hagan Chemicals & Controls, Inc., Dept. OGJ, Hagan Building, Pittsburgh 30, Pa.**

●

Newest closed circuit TV system

. . . offers a choice of five cameras and two monitors. The basic general purpose camera provides 550 to 600 lines horizontal resolution, weighs 12 lb., and measures 5½ by 7 by 11 in. It puts out a 1-volt signal into a 75-ohm coaxial cable and uses a standard 16 mm. C lens mount. It can accommodate a remote-control four-lens turret.

The industrial monitor has a 14-in. screen and provides 600-line resolution. A number of mounting, optical, and distribution accessories are available. SOURCE: **Motorola, Inc., Dept. OGJ, 4501 West Augusta Boulevard, Chicago 51.**

●

Two sizes of oil-well pump control

. . . handle motor ratings up to 75 hp. at 762 or 880 volts. All elements except the overload relays are housed in a sealed compartment in the weatherproof enclosure.

Components include a fusible isolating switch, three-phase motor starter with three overload relays, lightning arrestor, program time clock, time-delay restart timer, start button, and hand - off - automatic selector switch. Control circuits operate at 110 volts through a control transformer. Source: **Square D Co., Dept. OGJ, 4041 North Richards Street, Milwaukee 12.**

Withdraws composite sample of pipe line fluid at rate proportional to pipeline flow.
- Sample stored at pipeline pressure.
- Variations in line pressure have no effect on operation.
- Wide flexibility — 5 samples per bbl. to 1 sample per 42 bbls.
- Paced by Positive Displacement Liquid Meter.
- Sampler furnished completely assembled and mounted on sturdy base.

MECO Pipe line Sampler consists of a Pilot Type transmitter mounted on and paced by a positive displacement meter.
- An adjustable proportioning slide valve — operates in clean oil.
- Sample cylinder (single or dual) with piston position indicating rod.
- A clean oil reservoir.

Pipe line sampler available to 600 psig operating pressure.

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specify MECO PIPE LINE SAMPLER

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Full SCOPE of
COMPRESSORS from...

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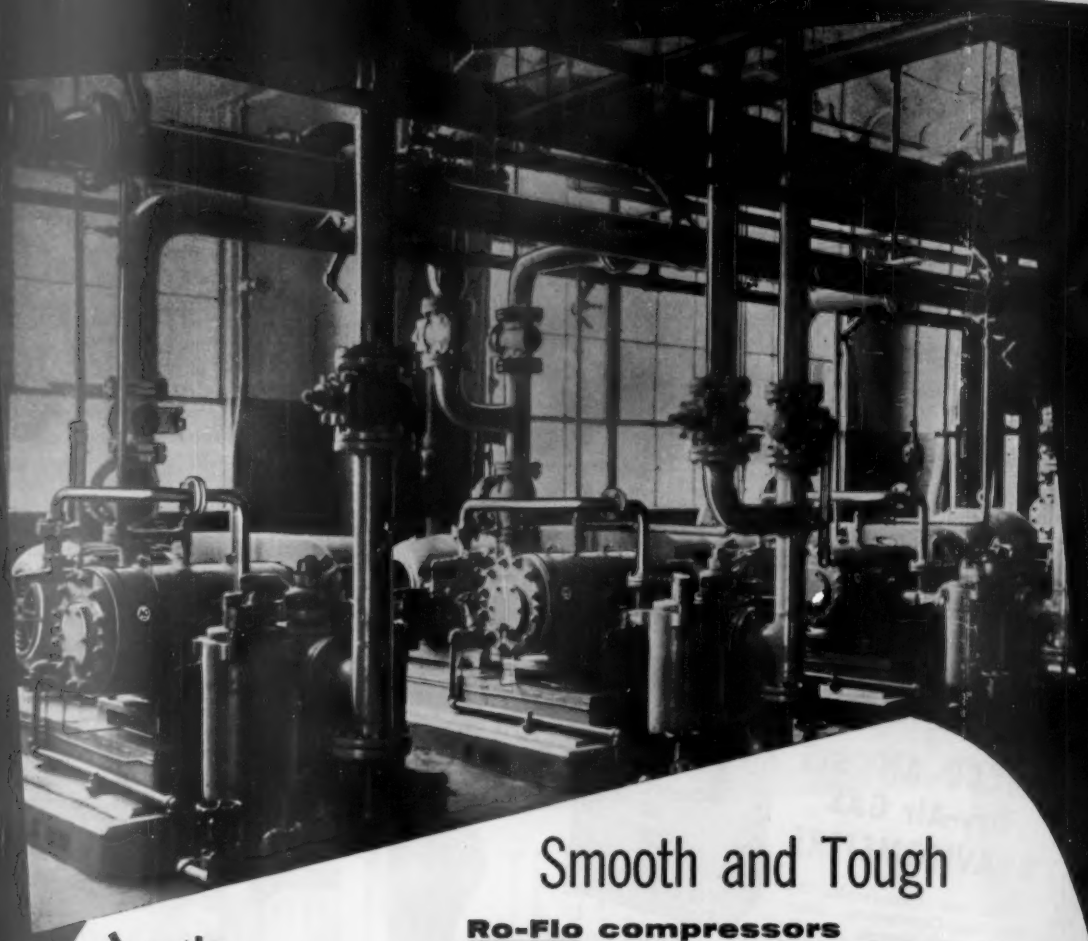

Smooth and Tough

Ro-Flo compressors eliminate underlying causes of high maintenance

Ro-Flo compressors stand up as no other compressors can, on such jobs as agitating, aerating, test drilling, air lifting, filter service, operating air tools, removing press cake from filters, and calking tank and pipe lines.

The inherent wear and tear from the vibration and shock of reciprocating machines is eliminated in the smooth *Ro-Flo* rotary action. The fall-off in efficiency, inevitable with other units, never takes place with a *Ro-Flo* compressor.

For smoothness, for toughness, for simple installation and easy maintenance choose a *Ro-Flo* compressor.

Contact your nearby A-C office, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Ro-Flo is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-5960-P

New rock bit penetrates faster

. . . and lasts longer than older types of bits. Designed for soft top-hole formations, the OSC-3A tricone bit drills up to 30% more footage and at an 18% faster rate of penetration than bits previously used, the maker reports.

The bit uses the long, slim, strong teeth introduced previously on the maker's OSC-3 bit. The new design differs from the OSC-3 bit with several features added specifically to drill softer formations faster. These include an increased tooth height resulting in a deeper "bite" that speeds penetration, fewer number of teeth make contact on bottom increasing the gouging-scraping action, and fewer heel teeth to increase self-cleaning action.

The OSC-3A bit with conventional watercourses and the OSC-3AJ for jet drilling will help rig operators reduce top-hole formation-drilling costs. Source: **Hughes Tool Co., Dept. OGJ, Box 2539, Houston.**

●

Newest retrievable gas-lift valve

. . . now available is fluid-operated by a predetermined hydrostatic head in the tubing. It is designed for lifting multiple completions using the tubing-casing annulus for a common reservoir of supply gas.

Because of the Model CM1-FS-CK valve's sensitivity to tubing pressure and its relative independence of casing or supply gas pressure, it permits efficient "common reservoir" multiple zone lift where two or more strings of fluid-operated valves receive their gas supply from the annulus. Since tubing pressure controls the opening of both or all strings of valves, "valve interference" is overcome, and each formation in the multiple-zone completion automatically controls gas inlet into its tubing string independently of the other zones. Source: **Macco Oil Tool Co., Inc., Dept. OGJ, Box 7288, Houston.**

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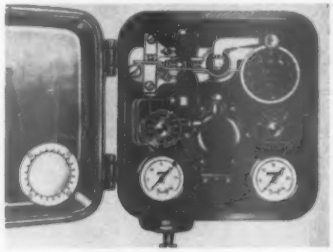

Level control combines two actions

. . . in one compact case—proportional plus reset control. The Type 2502 Level-Trol has a pneumatic proportional band adjustment and reset rate adjustment to give stable control with virtually no deviation from set point.

Proportional band is adjustable from 10 to 200%. Reset time is adjustable from 0.005 to 1.0 minute per repeat. The control can be obtained with either direct or reverse action. This can be changed easily in the field. Source: **Fisher Governor Co., Dept. OGJ, Marshalltown, Iowa.**

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The World Over
—wherever there is gas

ARCCO-ANUBIS
Dry-Air GAS
GRAVITOMETERS

This new Arcco-Anubis Dry Air Gas Gravitometer determines and records specific gravity of gases automatically corrected to the humidity content of the air. The difference in weight between a column of GAS and equal column of DRY AIR is measured. This ratio represents the true specific gravity of the sample.

One bell of the instrument is filled with gas which is being measured, and the other bell is filled with dry air. Otherwise, except for the new instrument having one column for gas and one column for dry air, the unit is identical in operation to the standard gas gravitometer When calibrated and properly installed, these instruments require little attention other than to wind the clock, ink the pen, and change the chart. Send for bulletin No. 101-R3.

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SCOPE in MOTOR DEVELOPMENT from . . .

ALLIS-CHALMERS

ACID AREA APPLICATION. Safety equipment and clothing are a "must" for personnel in the acid atmosphere of Dow's chlorine plant at Freeport, Texas. This **Super-Seal** motor came prepared, too — with **Poxeal** insulation guarding the stator.

2-YEAR ACID TEST!

Open motor beats enclosed type at its own game

In a tough acid pump installation, Dow Chemical's Texas Division experienced no end of motor troubles. It seemed nothing could stand up in that humid, corrosive atmosphere. Reports Dow: "Even with totally enclosed motors, winding failures were frequent." And, they might have added, expensive.

Then came *Super-Seal* motors — Allis-Chalmers open-type motors with amazing *Poxeal* insulation. A durable case of epoxy-resin encloses the winding end turns and slot portions of the stator . . . the most complete protection ever developed. Result? The *Super-Seal* motor, after two years of continuous operation in the acid area, is as good as ever. So good, in fact, that Dow has ordered 150 *Super-Seal* motors for a new chemical plant at Freeport, Texas.

Isn't it time to revaluate *your* motor standards? There's a good chance that costly enclosed motors are no longer needed. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

A-1036-C&P

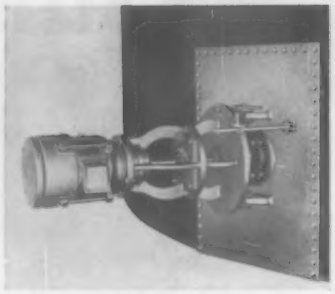
A-C ALLIS-CHALMERS

SUPER SEAL

SHOWCASE . . .

New Equipment

Tank mixer resuspends paraffin



. . . in 500 through 3,000 bbl. lease tanks. It is expected to be particularly useful where tanks must be kept in continuous service. The unit normally mounts in a cover plate that fits standard tank cleanout doors. This does away with the need for fitting or welding in the field.

One prominent feature is that the drive unit can be readily separated from the tank unit so one driver can be used on several tanks at one location. Mixer angle can be changed through a range of 40°. Four mixer sizes are obtainable with motor ratings from 1 through 3 hp. Source: **Jensen Engineering Co., Dept. OGJ, 5354 South Garnett Road, Tulsa.**

●

Replaceable-blade string tools

. . . have been developed that convert for use as uphole guides, as casing mills, or as bit stabilizers with the simple changing of blades right on the rig. The Series 165 tool uses no welding, locking nuts, or plates to hold the blades. Instead, it uses elastic steel pins inserted into contoured longitudinal grooves on each side of the blades and in the body.

The maker points out that, in this method, there is nothing to come loose in the hole to cause expensive fishing jobs. The tool uses soft steel blades as a guide tool, hard-surfaced blades as a stabilizer, or tungsten-carbide-faced blades as a reamer of mill. Source: **Kinzbach Tool Co., Inc., Dept. OGJ, P. O. Box 277, Houston.**

●

Machine puts lands on pipe bevels

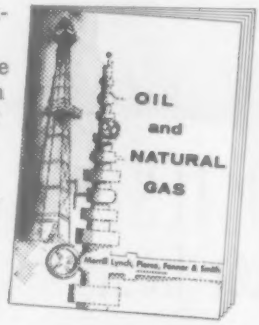
. . . and smooths the bevels automatically. It is a grinding machine driven by an electric motor and called the Bevel-Land grinder. It replaces the time-consuming method of using a file and hammer or hand grinder to clean and land bevels.

Two models of the machine are made. They handle pipe sizes from 6 to 36 in. Easily portable, the machine can be locked in place inside the pipe in a few seconds. A simple adjustment of the grinding-wheel angle changes the machine from a cleaning to a landing position. Source: **H&M Pipe Beveling Machine Co., Dept. OGJ, 311 East Third Street, Tulsa.**

Big Story!

Any way you look at it, that's oil. A multi-billion dollar industry that supports millions of American employees, pays annual dividends to more millions of stockholders, supplies 70% of our national energy —and still has to fight with profit-pinching problems of world politics, over-production, and steadily mounting costs.

Just how pressing are those problems? Where does the fight stand now? What lies ahead for stockholders in oil?



You'll find 40 pages of the very best answers we can give you in our brand new booklet called "Oil and Natural Gas".

It begins with a thoroughly objective look at the industry as a whole, explores supply, demand, and future markets, covers foreign operations, Soviet competition, the muddle in the Middle East—and then winds up with individual digests on 73 leading companies in the field with tabulated details on earnings, prices, dividends.

If you own any oil stocks, or wonder if you should, we think that "Oil and Natural Gas" belongs at the top of your reading list.

For a free copy, without obligation of any kind, simply call or write to—

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- Saves Time, Trouble and Money

The new Armstrong high-pressure gas trap illustrated *automatically* drains the system without gas loss. This completely reliable trap incorporates the time-tested Armstrong steam trap mechanism, adapted to the service.

Construction is of highest quality—forged steel body and cap, stainless steel working parts, heat-treated chrome steel valve and seat. Open-float bucket cannot collapse.

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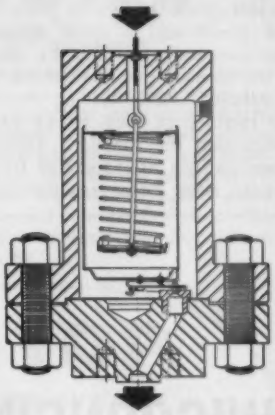
How It Works

Bucket is first primed with water, the weight of which compresses spring and closes valve. As condensate enters at top, it spills over side of bucket and begins to fill body of trap. When level gets about half-way up bucket, buoyancy of bucket plus spring action overcomes pressure and lifts bucket, opening valve. As condensate discharges, bucket loses buoyancy and sinks, closing valve. Valve *always* closes before all condensate is discharged, thus assuring a perfect water seal at all times.



4 SIZES

Trap No.	2315-S	2415-S	2515-S	3515-S
Max. Pressure	1000 lb	2000 lb	3000 lb	3500 lb
Capacity at Max. Pressure	7000 lb/hr	4200 lb/hr	3000 lb/hr	300 lb/hr
Pipe Connections	1", 1¼", 1½"	1", 1¼", 1½"	1"—1¼"	1"—1¼"

See our catalog in Refinery Catalog

pre-assembled VACUUM TANK

Ready to Mount on Your Truck

SELF-CONTAINED MODEL WT is made with capacities of 35, 40, 45, 50 and 55 bbls. Comes complete, ready for work. Has its own gasoline engine, pump and 4-way valve.

THOMPSON, the originators of the unitized vacuum tank, now makes available this self-contained model WT. It's factory-readied for you to mount on any CA 120" truck in your own shops. Put the WT on your truck in the morning; put it to work after lunch!

WRITE FOR SPECIFICATIONS, complete with blue-printed mounting instructions. If you'd like to see a Thompson Unitized Vacuum Tank at work, we'll tell you where, in your own area, you can watch it save time and money — pay for itself time and time again. Write today.

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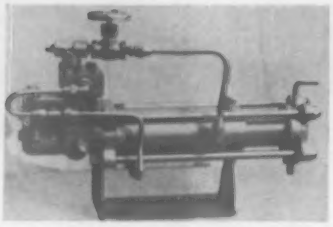
SHOWCASE . . .

New Equipment

New glycol pump for dehydrators

. . . just made known is powered by rich glycol and a small amount of high-pressure gas from the absorber of the dehydrator on which the pump is installed. After driving the pump, the mixture of rich glycol and gas passes into the reboiler. There, hydrates and gas are separated from the glycol. After being regenerated, the



glycol goes back into the suction inlet of the glycol pump for reinjection into the absorber. The only fuel consumed in powering the pump is a small amount of entrained gas.

Pump capacity ranges from 6 gal. an hour at 6 strokes a minute to 60 gal. an hour at 60 strokes a minute. Maximum working pressure is 1,500 psi. Source: **Texstream Corp., Dept. OGJ, Box 9127, Houston.**

●

For pipeline pumps, 3-in-1 switch

. . . and gage combination has been perfected. Only one instrument is needed for a pump or compressor powered by an internal-combustion engine. The Series 45 switch-gage combination serves as an automatic low-pressure switch, high-pressure switch, and an accurate pressure gage.

Accuracy is 2% of scale and shipping weight is 5 lb. The case is weather and dusttight. The pipe-thread connection is ¼ in. for pressures to 1,000 psi. and ½ in. for pressures from 2,000 to 20,000 psi. Source: **Frank W. Murphy, Mfgr., Dept. OGJ, Ranch Acres Station, Tulsa.**

●

New tricone bit design perfected

. . . for drilling such soft formations as gypsum, red bed, and limestone. Compared with conventional bits for this purpose, this new KWC bit has less teeth which are more widely spaced and deeper cut for more penetration. All three cones have L-shaped heel teeth for long gage wear.

Bit sizes range from 2⅛ to 7⅞ in. with full or jet-hole water or air courses. Source: **Oil Tool Mfg. Co., Inc., Dept. OGJ, Box 24, Tonkawa, Okla.**

WISCONSIN-POWERED gathering pump

beats the weather... stays on-schedule

WISCONSIN-POWERED ROTARY PUMP is specially designed to prevent gas-lock when handling crudes with a high flash point at 200 psi.

Texas heat sends lizzards and rattlers under ground fast. Its cold can freeze a longhorn's tail as stiff as its horns. But mean as it is, the weather can't crimp the year-around dependability of the VH4D Wisconsin air-cooled engine shown above.

The workhorse VH4D is tailored to withstand weather extremes. It starts fast and works smoothly at temperatures ranging from sub-zero cold to 140° F. Its built-in load-lugging power absorbs sudden shock loads effortlessly without stalling.

For this application, the engine is fitted with special high-compression heads. It has automatic high-temperature safety switch and low oil pressure cut-off switch. Stellite exhaust valves and inserts, and valve rotators improve engine efficiency and extend valve life up to 500%.

Precision-fitted construction and trouble-free air-cooling combine to deliver the most hp-hours of service with the least care. There are no dry-ups or freeze-ups—and no radiators, water pumps, water, or anti-freeze—to complicate servicing or to cause power failure due to wear or neglect.

Specify Wisconsin air-cooled engines for your oil-field utility units. Write for Bulletin S-237 covering the entire line—3 to 56 hp.

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Milwaukee 46, Wisconsin

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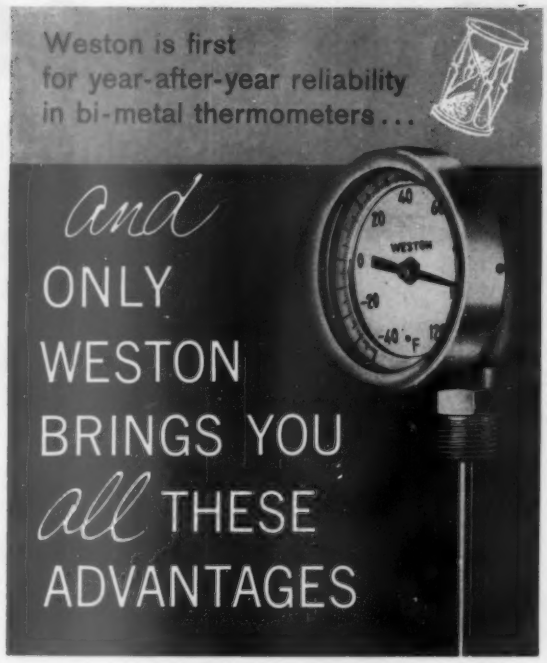
World's Largest Builders of Heavy-Duty Air-Cooled Engines



Breadth of line . . . number of desired features . . . quality of craftsmanship . . . ruggedness and stability – from any point of view, Weston thermometers are unsurpassed. Yes, the company that introduced the bi-metal to industry continues its leadership. That's why your smartest move is to entrust your process to no thermometer but a Weston.

FOR EXAMPLE, LOOK AT ALL THE ADVANTAGES YOU GET WITH THE NEW WESTON '4000' SERIES:

- ALL STAINLESS STEEL CONSTRUCTION, INCLUDING WELDS, AND IN-LINE SCALES AND POINTERS TO ELIMINATE MISREADING DUE TO PARALLAX
- EXTERNAL ADJUSTMENT FEATURE PROVIDED AS STANDARD EQUIPMENT
- REMOVABLE BEZELS FOR EASY WINDOW REPLACEMENT IN THE FIELD
- ADVANCED GASKET MATERIAL TO PROTECT AGAINST "BREATHING" AND LEAKAGE EVEN UNDER EXTREME OUTDOOR ENVIRONMENTAL CONDITIONS AND LOW TEMPERATURE MEASUREMENT SERVICE WITHOUT FOGGING OR FREEZE-UP
- GUARANTEED ACCURACIES WITHIN 1% OF RANGE OVER ENTIRE SCALE
- FULL LINE OF SIZES, STEM LENGTHS AND RANGES IN BACK AND BOTTOM-CONNECTED MODELS

For full information and name of local distributor, contact your local Weston representative . . . or write to Daystrom-Weston Sales Division, Newark 12, N. J. *In Canada: Daystrom Ltd., 840 Caledonia Rd., Toronto 19, Ont. Export: Daystrom Int'l., 100 Empire St., Newark 12, N. J.*

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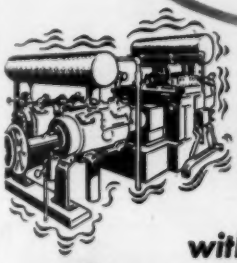
Bi-metal Thermometers

WORLD LEADER IN MEASUREMENT AND CONTROL

STOP
intake or exhaust
NOISE

Nerve-wracking, efficiency-robbing exhaust and intake noise is exacting a costly toll in many plants. Errors, accidents and compensation claims, high employee turnover and absenteeism, and strained community relations are often the result of excessive noise from internal combustion engines, compressors, turbines, blowers, etc.

STOP
pipe system
PULSATION



Pulsation from compressors, vacuum pumps and similar equipment produces vibration that causes rapid deterioration of equipment, skyrockets maintenance costs and sometimes even threatens the structure housing the system.

with

BURGESS-MANNING SNUBBERS

Designed for a specific job by experienced engineers, excessive noise or vibration can be eliminated. Such snubbers, either standard or specially designed, are built around the exclusive Burgess-Manning Snubbing Principle, proved by thousands of successful installations.

In addition to silencing and surge control, Burgess-Manning Snubbers can also incorporate these plus features,—Spark-Arresting, Water Separation and Heat Recovery.

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or Vibration

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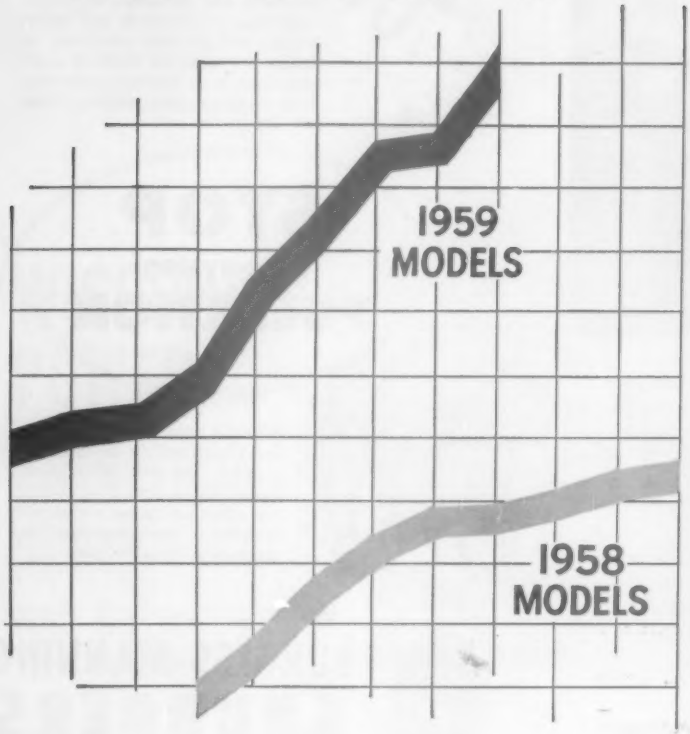
The BIG SUCCESS

1959 FORD SUPER DUTY TRUCK SALES MORE THAN DOUBLE THOSE OF LAST YEAR



1960 FORD SUPER DUTIES

SKYROCKETING SALES OFFER ADDED TESTIMONY TO THE TOUGHNESS AND RELIABILITY OF FORD "BIG V'S"— *NOW* THEY'RE MORE DURABLE, MORE FLEXIBLE THAN EVER!

Ford's increase in sales of Super Duty Trucks, while impressive in itself, by no means tells the whole story. Over half of the 1959 unit sales were the result of repeat orders from operators like Trucking Contractors, Inc., who bought because the Ford "Big V" provided the kind of performance and durability needed for their work.

And for 1960, the Ford Super Duties offer additional refinements designed to provide an even greater degree of dependability. Bigger optional axles and increased GVW's permit greater payloads and more profitable operation. Automatic radiator shutters to keep the engine temperatures within the most efficient operating range, submerged-type electric fuel pump to prevent vapor lock, and redesigned wiring for longer, more dependable operation are but a few of the improvements which add to the performance and durability of these units.

The changes offered for 1960 were tested and evaluated by America's foremost independent automotive research organization. The certified results of the studies by this impartial firm (name available on request) provide proof that Ford's Super Duty Trucks are even more dependable.

- **Certified Durability through closer temperature control!** Independent research engineers certify that Ford's thermostatically controlled radiator shutters kept water temperature between 168° and 188° in severe mountain grade operation. The test truck with shutters blocked open

of the Big Truck Field

"Tried 8 in '58—bought 20 more in 1959," says Curtis E. Brost, President, Trucking Contractors, Inc. "In 1958 we bought 8 Ford T-850's with lightweight chassis options and specially built 5-batch bodies which gave us a full extra batch per truck. A 5-batch load is a real strain on the truck when you consider we're 'running the ditches' on this highway paving job in North Dakota. These T-850's worked out so well that we ordered 20 more in '59. Our Ford Tandems with the 477 engine give us good mileage and the drivers are real happy with them. It's a rough go on trucks with soft footing and dust so bad we have to drive with headlights on. Despite such operating conditions, downtime has been negligible and these '477' Fords have given us less trouble than other trucks we have operated."

with Certified Durability

under same operating conditions had a temperature range from 102° to 181°. The temperature variation of only 20° with shutters means less expansion and contraction in engine block and cylinder heads. Higher temperatures with radiator shutters permit leaner fuel-air mixtures with less possibility of raw gas washing down cylinder walls. Warm oil circulates more freely, reducing internal friction. All these factors contribute to longer engine life.

- **Certified Dependability with longer-lived electrical system!** Ford's '60 improved wiring harness and the 1959 wiring harness were subjected to shaker table tests plus constant exposure to oil and water vapors and temperatures of 200°. Certified results prove that the greater resistance to deterioration by heat, oil, water and abrasion obtained with the 1960 wiring harness more than doubles wiring harness life.

- **Certified Reliability with Ford's submerged-type electric fuel pump!** Dynamometer tests of engines with submerged-type electric fuel pump and conventional mechanical type showed that vapor lock was nonexistent with Ford's electric pumps at temperatures up to 200°, whereas incipient vapor lock with mechanical pump resulted in a power loss of 9% at an underhood temperature of 200°.

Test results like these plus the experience of satisfied users are important but that is not all. For 1960, the Super Duty line has been broadened to provide even more flexibility in power train options. Get the facts from your Ford Dealer!

FORD TRUCKS COST LESS

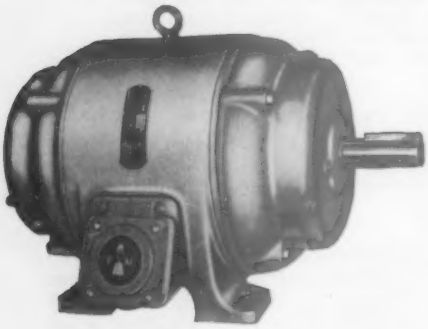
LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

Low-cost jackpower starts with quality!

Fairbanks-Morse "ZC" Engines

The most dependable, most thoroughly proven engine available today for pumping service. The rugged, simple Fairbanks-Morse "ZC" is known the world over for its rock-bottom economy—its ease of starting in coldest weather—its efficiency on both gas and gasoline, with full-power switch-over to either. Clutch and sheave mount on either end of crankshaft for maximum adaptability. Six "ZC" sizes range from 3 to 30 horsepower.

Fairbanks-Morse Guarded Dripproof Motors



A completely guarded squirrel-cage induction motor with exclusive design for oil field service. Heavy-duty protected frame prevents entry of dripping liquids, flying chips or falling particles. Available with high torque, normal starting current—high slip, high starting torque—or general purpose normal torque. Ratings from ½ to 40 hp., 3600 to 600 rpm.

See your local supply store or write Fairbanks, Morse & Co., Oil Field Division, 1713 N. Market St., Dallas 2, Texas. Ask for new F-M Oil Field Equipment Bulletin.

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DIESEL, DUAL FUEL AND GASOLINE ENGINES • ELECTRIC MOTORS • PUMPS • COMPRESSORS
GENERATORS • SCALES • MAGNETOS • HOME WATER SYSTEMS

SHOWCASE . . .

New Literature

Industrial maintenance equipment

. . . is described in new, available Catalog P-9. It contains complete descriptions of pulling systems, and includes photographs showing pumps and hydraulic shop presses.

The 24-page literature shows how the units remove and install gears, bearings, pulleys, shafts, and couplings fast and easy. Illustrations and descriptions of industrial wrenches are included. Source: **Owatonna Tool Co., Dept. OGJ, 621 Cedar Street, Owatonna, Minn.**

Flexible cushion couplings

. . . called Para-flex — ranging from fractional to 190 hp. per 100 r.p.m.— are described in a new publication. Twelve-page Bulletin A669C offers photos, drawings, and text to explain design features and operating characteristics of the couplings. Included are detailed tables of horsepower ratings, prices, dimensions, and service factors for many applications. Source: **Dodge Mfg. Corp., Dept. OGJ, Mishawaka, Ind.**

416-page instrument-components

. . . Catalog 20a, being offered free upon request, lists over 10,000 items, including gears, shafts, collars, couplings, speed reducers, differentials, and other precision items available.

In addition to drawings, specifications, and prices, the new catalog contains separate sections dealing with technical data, breadboard kit, and precision tool components. Source: **PIC Design Corp., Dept. OGJ, 477 Atlantic Avenue, East Rockaway, L. I., N. Y.**

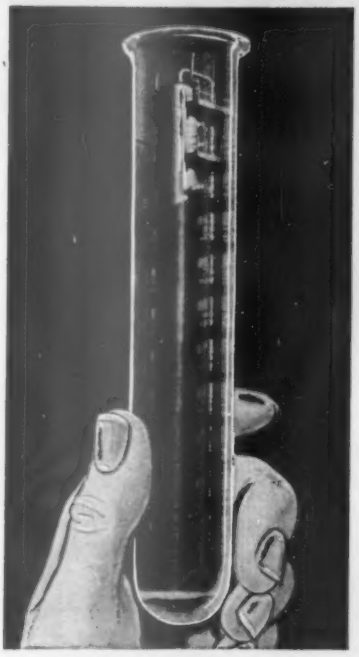
High-capacity lift trucks

. . . designed for safe, speedy handling of loads up to 20 tons are illustrated in a new brochure. The eight-page literature outlines the trucks' performance, maneuverability, traction, and stability. Included are engineering and construction features. Source: **Hyster Co., Dept. OGJ, P. O. Box 847, Danville, Ill.**

Direct-reading performance meter

. . . for diesel, gasoline, natural gas, and steam engines is detailed in new Bulletin K15A. The two-page publica-

Oakite
ECP...



Best way to clean a tower

EXPERIENCE proves that the best way to clean a tower is the Oakite ECP way . . . which recommends chemical circulation. For one scale-choked absorber, it meant only 32 hours off-stream. The tower was thoroughly cleaned in 3½ days *less* time, at $2,250 less direct cost than by previous methods.

Developed specifically for your refinery, an Oakite ENGINEERED CLEANING PROGRAM takes into account your soil problems, cleaning needs and available equipment. It makes individual cleaning recommendations for everything from tank stripping to tower turnarounds. It puts "do-it-yourself" cleaning on a practical, profitable basis.

The Oakite Engineer follows through with technical service. His personal help assures satisfaction with results. Behind him stands the finest chemical cleaning research facilities in existence. Call him in. Or write for bulletin. Oakite Products, Inc., 39 Rector Street, New York 6, N. Y.

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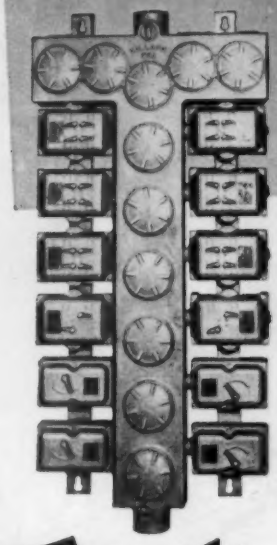

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By increasing the capacity and speed of a pump, upwards of $300 to $400 can be saved on some sizes.

Entirely new, modern foundry facilities and manufacturing processes enable the complete line of Viking alloy pumps to meet still more exacting requirements.

If your specifications call for alloy pumps, see how you, too, can save on our new line of full speed Vikings.

For information, send today for catalog MT.

VIKING PUMP COMPANY

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The Air Liquide stream of experience has been flowing around the world for over half a century. Gaining year by year broader and accurate know-how, it has produced hundreds of low-temperature gas separation plants all over the globe.

Whether you need a plant from an existing design or one especially designed for your particular requirements, Air Liquide can supply it. From the initial technical consultations, design work, manufacturing of plant and equipment, to the expert erection and start-up supervision, our widely experienced Research, Design, and Project teams smoothly coordinate with yours.

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tion describes construction and operation principles of the Pi-Meter Indicator which reads time-averaged pressure of engine cylinders, thereby permitting rapid engine adjustment for uniform cylinder performance.

According to the data sheet, pressure is read directly on the meter's dial in pounds-per-square-inch while the engine is running, eliminating charts, graphs, and computations.

The bulletin shows photos of the instrument, a cross-sectional pictorial view showing the construction of its internal works, and gives complete specifications. Source: **Korfund Co., Inc., Dept. OGJ, 48-15 Thirty-second place, Long Island City, N. Y.**

Study of refrigeration systems

... in modern gasoline plants discusses the relative merits of vapor compression and ammonia absorption systems for both large and small plants. Eight-page Bulletin 172 gives special emphasis to design, equipment, and operating factors which influence the over-all economics of any system. Source: **Clark Bros. Co., Dept. OGJ, Olean, N. Y.**

54-page timing-control catalog

... which emphasizes descriptions and technical specifications can now be obtained. The publication contains sections on programing and switching devices, multicam timer kit, running-time meters, reset-time totalizers, and time delays.

Types of timers discussed include cam, time-delay, interval, signaling, recycling, and explosionproof. The catalog includes photos, design features, applications, general information, dimensions, charts, and price lists. Source: **Industrial Timer Corp., Dept. OGJ, 1407 McCarter Highway, Newark 4, N. J.**

Diesel oil-field engines brochure

... covers engines from 20 to 1,650 hp. in three cylinder sizes. Available upon request, the 24-page publication offers additional material on diesel marine engines for crewboats, tugboats, and supply vessels; diesel generator sets; and automotive engines. Source: **Detroit Diesel Engine Div., General Motors Corp., Dept. OGJ, Detroit 28.**

Portable vacuum cleaners

... for use in hazardous areas are discussed in a new single-page literature piece, free for the asking. Powered from existing compressed air lines, the units have no motors and no electrical wiring. Thus, the literature reports, nonsparking operation is assured and cleaners may be used safely in dust or fume-filled atmospheres. The publication includes a photo and a table of specifications. Source: **Spencer Turbine Co., Dept. OGJ, 486 New Park Avenue, Hartford, Conn.**

One-man hinged closures

... with built-in safety features for vacuum, low and high-pressure service

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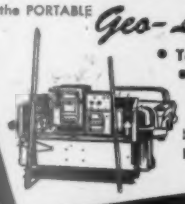
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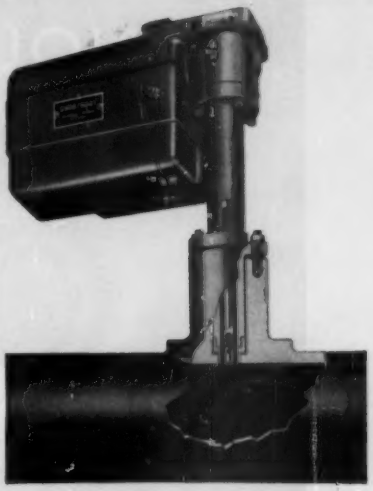
SACHSE ELECTRIC INC.
BATON ROUGE LA.

Great things are happening in AutroniC® Control
TOUGH PROBLEMS ARE NO PROBLEM

FOR THIS FOOLPROOF, FOUL-PROOF PRESSURE TRANSMITTER

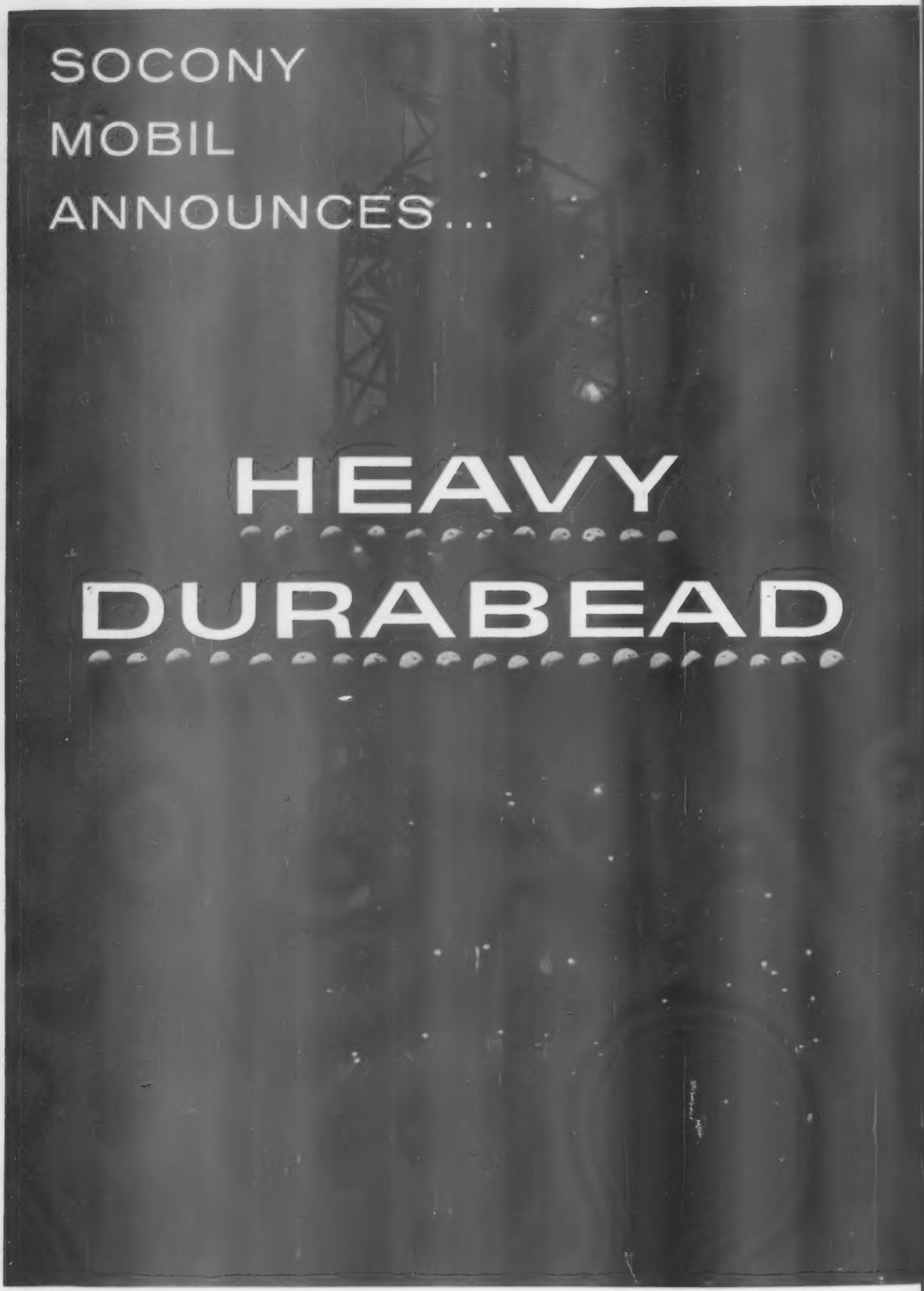
Here is a primary sensing element for those tough jobs you'd like to forget. Mounted right on the process pipeline or tank, the Swartwout Flush Diaphragm Pressure Transmitter will effortlessly measure pressure or liquid level of polymers, slurries, asphalts, viscous fluids, molten metals and other difficult media. No stagnant pressure lines, no steam jacketing necessary ... the stainless steel transmitter diaphragm fits flush with the inside of the vessel.

A friction-free linkage multiplies diaphragm motion and actuates the core of a differential transformer to produce a 0-0.5V AC signal for any Swartwout AutroniC indicator, recorder or controller. Sensitivity is better than 0.005%, reproducibility 0.1%, accuracy 1.0%.

The Flush Diaphragm Pressure Transmitter is just one unit in the constantly-growing AutroniC family of electronic instrumentation . . . a family that includes all necessary components for complete electronic control of any process parameter.

For details on the Flush Diaphragm Pressure Transmitter, request Bulletins A-713 and A-718. The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.

SWARTWOUT
. . . world leader in electronic process instrumentation
S.A. 1858


SOCONY
MOBIL
ANNOUNCES...
HEAVY
DURABEAD

NOW SOCONY MOBIL'S CATALYST RESEARCH BRINGS YOU:

Lower operating costs
Greater cracking capacity
Reduced construction costs

For years Socony Mobil's scientists have been leaders in catalyst research and engineering. In 1943 they put the first Thermofor Catalytic Cracker on stream. Under wartime pressure they originated and perfected for commercial use the first bead catalyst. With the war over, Socony Mobil researchers continued to improve catalytic refining. By 1950, the Airlift TCC was an accomplished fact. Then in 1957 came Durabead, a bead catalyst that reduced cracking costs, increased refinery efficiency.

Now Socony Mobil catalyst research brings the petroleum industry another important advance—Heavy Durabead!

This new bead catalyst offers all of the advantages of Durabead—plus important new ones. It makes possible construction of TCC units at a 20% reduction in cost. Used in present TCC units, it increases reactor and regenerator capacities as much as 50% compared to chrome bead catalyst.

Once again Socony Mobil leads the way in producing a higher yield of salable products from a barrel of oil—making possible more profit for TCC licensees and operators of other moving bed cat crackers.

To learn more about Heavy Durabead, contact:

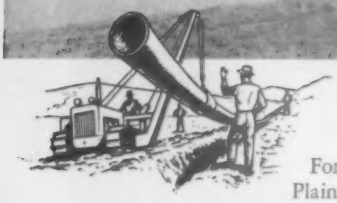
Process Promotion Department
Socony Mobil Oil Company, Inc.
150 East 42nd Street
New York 17, New York

Leader in catalyst research

Mobil

SOCONY MOBIL OIL COMPANY, INC.

This Controls These



For Badger Pipe Line Company, Des Plaines, Illinois. Nelson control panels, such as shown in the top photo, provide day-in and day-out service. This particular control panel includes (1) recording potentiometer for temperature (2) flow recorder controller (3) interface detector (4) pressure gauges and (5) pressure recorder controller.

Nelson delivers a board, built to the highest standards of workmanship, completely shop tested, and individually crafted to meet customer requirements. It will be a real show piece wherever it is installed. Sheet metal work, piping, wiring, finishing are done in such a manner that you know quality has been built into your board. Nelson's engineering know-how and engineering skill combine to produce instrument and control panels unequalled for quality, service and dependability.

Write for this brochure on Nelson Instrument and Control Panels It's yours for the asking.

At Nelson . . . *quality* comes first!

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

are described in a new brochure now available. Photographs in the four-page literature piece illustrate one-weld installation, easy maintenance, and one-man operation of the product.

Charts give dimensional specifications, and cross-sectional drawings describe design features of various sizes and types. Source: **Tube Turns Div., Chemetron Corp., Dept. OGJ, 222 East Broadway, Louisville 1, Ky.**

Tubing-joint engineering data

. . . on various types of joints is included in new technical Folder DS-59D, yours for the asking. Data covers tubing and joint or coupling outside diameter, wall thickness, makeup torque, burst and collapse strength, setting depth, and other information needed for engineering a tubing program.

Also included are simple formulas for calculating running clearance in casing for multiple strings. The eight-page publication is printed on heavyweight paper and folds out to make one flat sheet 33¾ in. long.

Thus, you can make immediate comparison between all tubing and connections generally available in selecting the most suitable combination for a given completion. Source: **Hardy-Griffin Engineering Corp., Dept. OGJ, 14522 Main Street, Houston 25.**

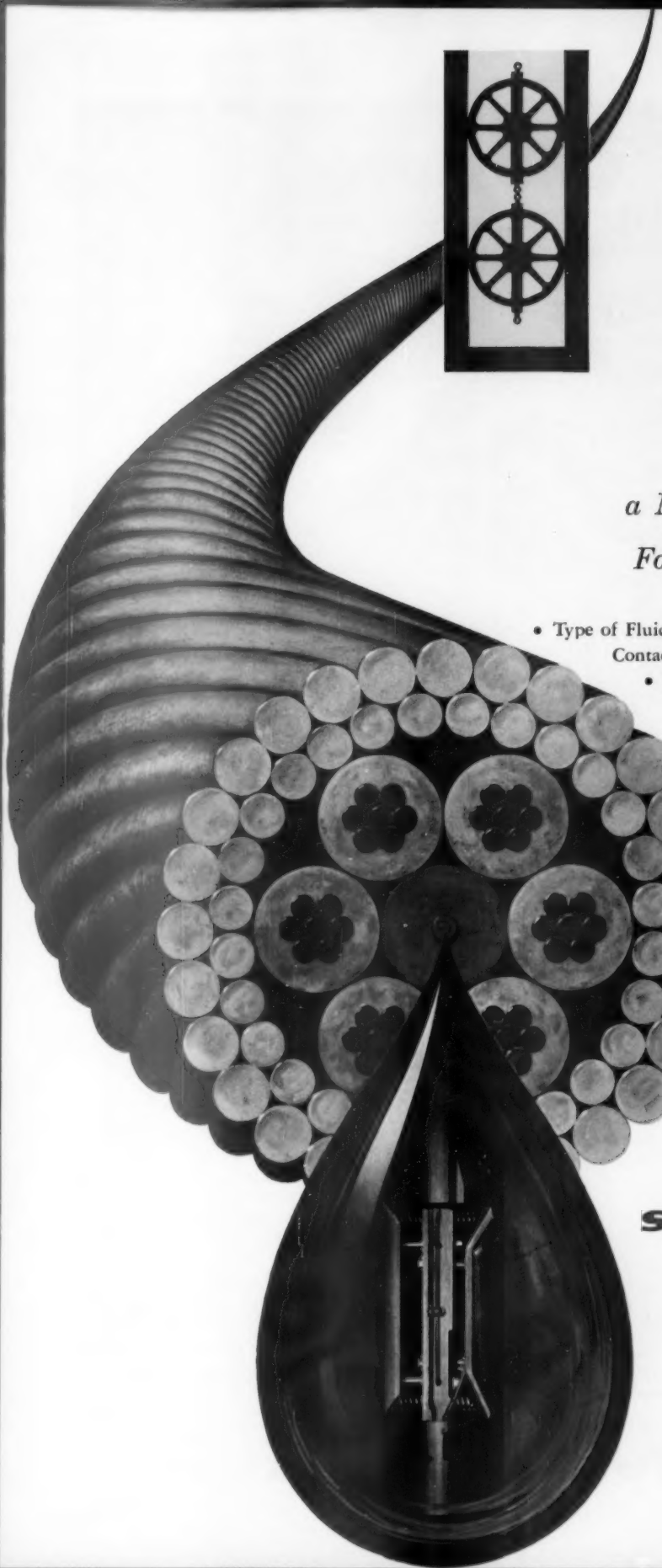
Guide to LP-gas metered service

. . . details handling, installing, and testing LP-gas meters. The colorful, illustrated booklet contains handy tables for simplifying meter selection and installation.

Tables cover: (1) approximate conversion factors for propane; (2) equivalent length of pipe for various fittings in feet; (3) sizing LP-gas pipe or tubing; (4) meter-selection chart—for average consumer loads; and (5) meter-history cards. Source: **American Meter Co., Dept. OGJ, 920 Payne Avenue, Erie 6, Pa.**

Air-sampling techniques booklet

. . . discusses several methods of determining the amount and size distribution of airborne dusts. The subject should be of particular interest to safety and process engineers. Small particles in air can account for adverse effects on health and can interfere with production processes that cause excessive wear in mechanical systems. Source: **Gelman Instrument Co., Dept. OGJ, Chelsea, Mich.**



The Formation Tester

by Schlumberger . . .

a Modern Wire Line Service

For Production Information

- Type of Fluid
- Gas-Oil Ratios
- Gas-Oil and Oil-Water Contacts
- Flowing and Shut-In Pressures
- Pressure Build-Up for Formation Pressure and Permeability Studies

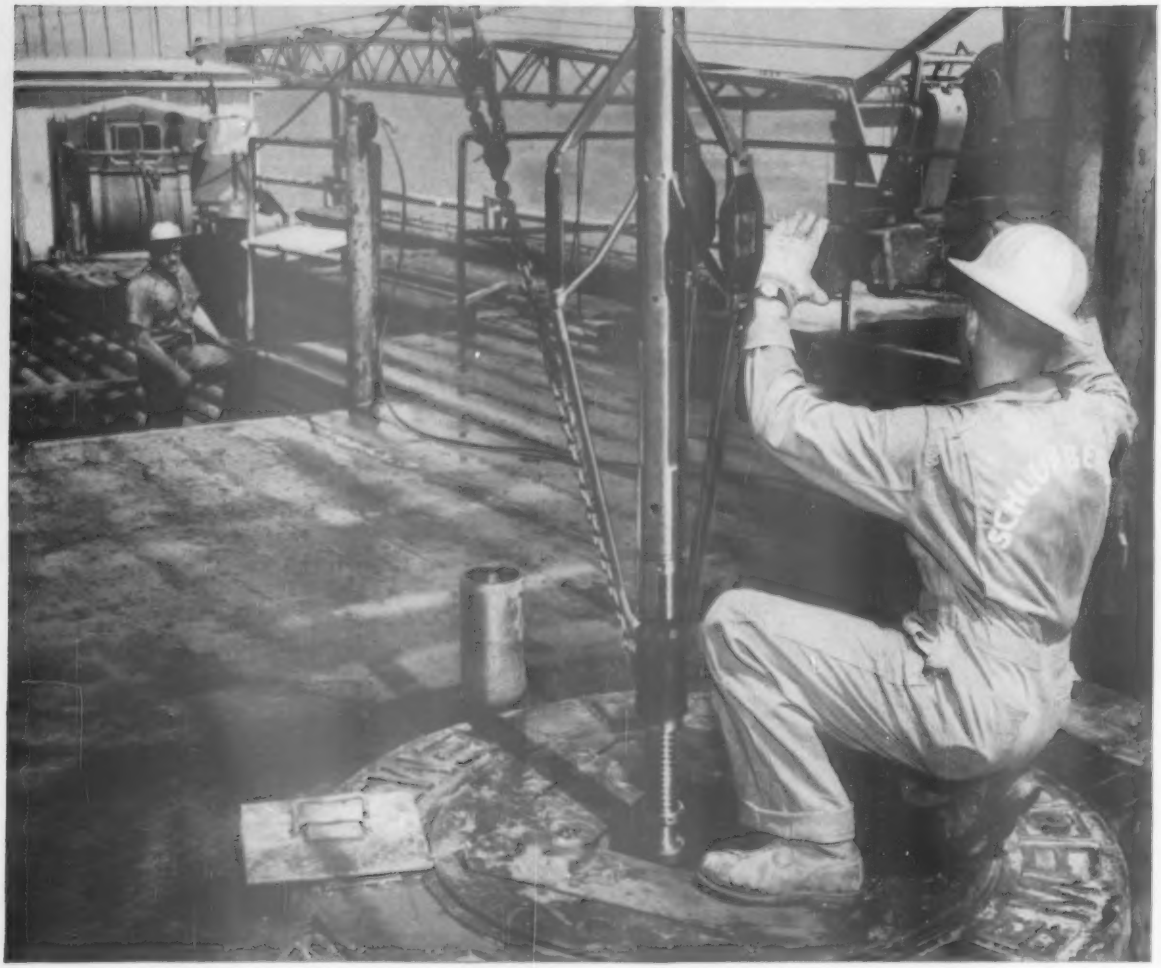
This is the information cabled to you at the surface by the Schlumberger Formation Tester.

The Formation Tester is another Schlumberger development for greater efficiency in oil-finding and production. You need only to drill the well, run Schlumberger logs, and use the Formation Tester in those zones showing promise of production.

Cut your well costs by employing this modern well completion tool — in either open or cased holes.

THE EYES OF THE OIL INDUSTRY®

SCHLUMBERGER



Logging a well with the Schlumberger Continuous Dipmeter. Non-magnetic "K" Monel alloy housing protects its reference compass as it registers subsurface formation slopes and changes.

How non-magnetic "K" Monel helps map mountains underground

One of the important "mapping" tools used to chart subsurface peaks and valleys and reduce dry holes is the Schlumberger Continuous Dipmeter. It measures and records dips and faults in formations, as well as the inclination of the hole, relying on a precision compass for a directional standard.

"K" Monel* age-hardenable nickel-copper alloy plays a key part in this dipmeter's operation . . . a housing of this non-magnetic alloy protects the delicate compass from shock and corrosion without affecting the compass reading.

Schlumberger engineers are well aware of the special properties of "K" Monel alloy. They've specified it for years in their Photoclinometer compass housing. Specified it, too, at many other critical points in Schlumberger instruments where corrosion, heat, pressure, shock, magnetism, or a combination, rule out common materials.

Your own producing costs may well be lowered by "K" Monel alloy in parts subject to corrosion, stress, or magnetic conditions. Get more information...send today for "Metals to Make Petroleum Production Equipment Produce More." For help in well logging problems, contact Schlumberger Well Surveying Corporation, Houston, Texas.

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

*Inco trademark

"K" MONEL®

EQUIPMENT MEN

Jefferson Chemical Co. names

. . . Gerald B. McLeod and Douglas M. Stuart to the firm's sales staff, according to R. E. Werley, Jr., sales manager. McLeod will be assigned to the regional sales office in Houston, and Stuart will go to Jefferson's Cleveland regional sales office.

McLeon most recently was employed by E. I. du Pont de Nemours, Inc., at Victoria, Tex. as an engineer in research and development. Stuart previously served as a technical section trainee for du Pont in West Virginia.

H. B. Burr, Jr. becomes v.p.

H. B. Burr, Jr.

. . . in charge of oil-field operations of Cummins Sales & Service, Inc., according to L. J. Troutz, president. The newly created post was established to meet demands of the company's continuing expansion, Troutz said. Burr, who joined the company 13 years ago at Wichita, was a sales engineer in the Fort Worth office before his promotion.

At the same time, it was announced that W. R. Bowman, general manager of Cummins Sales & Service de Venezuela, C.A., Caracas, will move to Oklahoma City to assume new duties there as division manager of diesel sales and service.

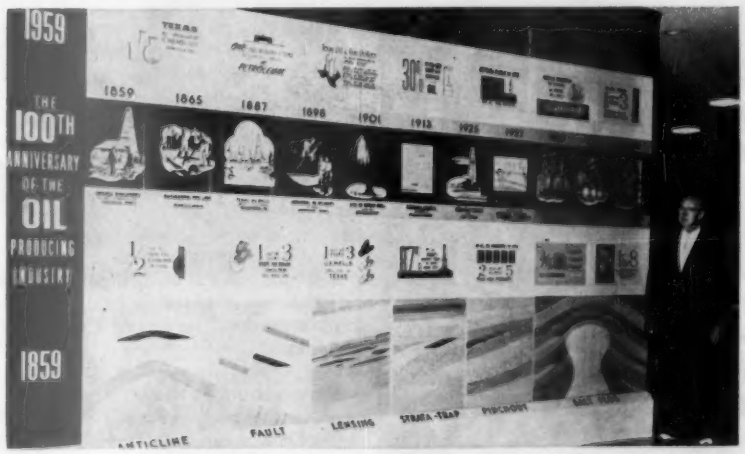
NEWLY ERECTED BUILDING of Thornhill-Craver Co., Houston, incorporates special receiving and shipping docks for fast handling of materials and products. The eighth plant-extension addition of Thornhill-Craver since 1938, the structure is 80 by 242 ft., and contains 19,360 sq. ft. of floor space. Other buildings in the complex include an 80 by 300-ft. main plant, a fabrication shop, an export crating structure, and an office building. Thornhill-Craver Co., organized in 1931 by Homer E. Thornhill, Kenneth Craver, and Charles W. Thornhill, manufactures products for drilling, production, and pipelines, including filtration systems for products pipelines and water-flood operations. The first product was the Unibolt coupling. Now the company also makes scraper traps, christmas-tree fittings, positive chokes, and adjustable flow beans, pipeline filters, and a new automatic safety valve for wellhead-pressure control. Thornhill-Craver Co. has sales representatives in Corpus Christi, Pauls Valley, Midland, Lubbock, Farmington, Shreveport, Los Angeles, Buenos Aires, Mexico City, Trinidad, Calgary, and Edmonton. Europe and the Middle East, as well as Venezuela, Columbia, and Peru, are traveled by personnel from Houston.

General Controls Co. conducts

. . . a series of special training sessions in Milwaukee for specialists in industrial controls manufactured by the company's Hammel-Dahl Division.

The course, supervised by Robert L. Farmer, manager of product training and services, was designed primarily to expand each specialist's scope of knowledge to include the firm's Foster Engineering Division line which includes pressure-reducing valves, safeties, regulators, and flow tubes.

General Controls acquired Foster Engineering Co., of Union, N. J., last February. The Hammel-Dahl Division is located in Warwick, R. I., where the Foster division recently has been located.



TRIBUTE TO CENTENNIAL of the petroleum industry is paid by the oil and gas department of Bank of the Southwest, Houston, as the bank lobby is filled with exhibits, art work, and operating models of industry equipment and methods. Highlighting the exhibit is this painted display which shows some of the industry's historical milestones, contributions of the industry to Texas, and typical geological subsurface strata. Pictured is Harold Vance, vice president and manager of the bank's oil and gas department.

Magnaflux conducts courses

. . . in nondestructive testing at the corporation's Chicago plant. This year thirteen 5-day (40-hour) sessions, which are still being offered, have covered the basics, theory, and practice of this testing.

Each 5-day class, which is limited to eight men, include a survey of the fundamentals and methods of fabrication used in metal working and studies the origin of defects in materials and parts. Included are the theory of magnetic particle and fluorescent penetrant inspection, techniques for creating indications of any defects, interpretation as to specific causes of defects, and evaluation of the part in question as to probable service life.

Further information may be obtained by writing to: Magnaflux Corp., 7300 West Lawrence Avenue, Chicago 31.

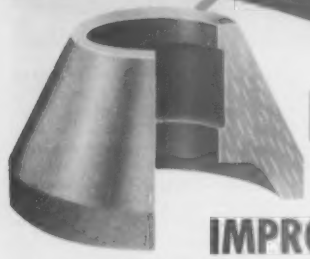
E.E. Eutsler is elected president

. . . of F. H. Maloney Co., announces F. H. Maloney, who vacated the presidency to become chairman of the board. The board also named H. B. Finch and Vice President James H. McBrien, general sales manager, to board membership. Eutsler continues as the company's general manager. Finch is controller.

Lee Dawson, Jr., was named man-

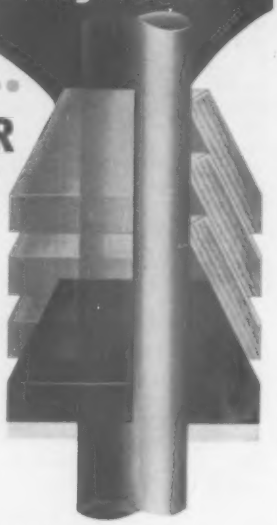
for BEST SERVICE and LONGEST WEAR..

...use ONLY HERCULES CONE-SHAPED PACKING RINGS in ALL Hercules Duplex Polished Rod Stuffing Boxes



NOW... ANOTHER IMPROVEMENT

After months of exhaustive field tests, HERCULES is now including a NEW, SOLID Split Bottom Cone Packing Ring in each set of HERCULES Cone Shaped Packing Rings at no extra charge. This new Split Bottom Cone Ring is solid, providing greater contact with the polished rod and a more substantial base for the upper Packing Rings, resulting in longer packing life. A complete set of HERCULES Cone-Shaped Packing Rings now consists of three *Regular* and one new *Split Bottom Cone Ring* for greater life and superior performance.



a type for EVERY requirement

1. HERCULES **SOFT** SPLIT CONE PACKING RINGS
2. HERCULES **HARD** SPLIT CONE PACKING RINGS
3. HERCULES **SPECIAL** LUBRICATED SPLIT CONE PACKING RINGS
4. HERCULES **HEAVY DUTY** SPLIT CONE PACKING RINGS

You can't afford to take chances with either "bargain" or "off brand" packing. One failure could be costly. The unique method of adjusting the Cone-Shaped Packing in HERCULES Stuffing Boxes, as compared with methods employed in conventional types of boxes, eliminates the possibility of efficiently or economically using any other type packing in HERCULES Duplex Stuffing Boxes.

ACCEPT NO SUBSTITUTES. Ask for and accept only HERCULES Cone-shaped Packing Rings for use in all HERCULES Duplex Stuffing Boxes.

Look for the HERCULES trade mark on the red and black carton.

All HERCULES Products are Available at Your Supply Store.

HERCULES TOOL COMPANY

Manufacturers of Oil Field Equipment

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. 90 West Street, New York, N. Y.

ager of Maloney's Tulsa office. He formerly was production expediter at the company's home office in Houston.

Morris L. Bradford is elected

M. L. Bradford

. . . executive vice president of Hoil Co., Tulsa, according to R. D. May, Hoil president. Bradford has been a principle stockholder in Hoil for several years.

Hoil manufactures oil-emulsion treating, testing, and metering equipment. Distribution is handled through Continental-Emsco Co.

Bob L. Smiley is appointed

. . . sales engineer for the northern division of Engineered Oil Tools, Inc., announces Peck Meier, general manager. Smiley will represent the line of Johnston hydraulic pumping units and related engineered production equipment items in North Texas, the Panhandle, Oklahoma, Kansas, and Canada.

The newly appointed sales engineer, previously employed by Johnston Testers, has had 9 years of field experience in drilling and production engineering. Smiley will be based at Oklahoma City, where he will assist Ed Williams, northern division manager, and company distributors with sales and engineering.

Fred E. Cooper, Inc. begins

. . . a $250,000 expansion program which will increase the company's general office space in Tulsa by 89%. The fabricating shop, which will be 95% larger, will be equipped with two overhead electric cranes having a hook lift of 20 ft.

The fabricating shop is expected to be of great benefit in building larger Cooper machines with portable derricks. Cooper's paint shop will be expanded by 178% with 20-ft. head room to handle the largest machines now being manufactured. Machinery overhaul space is being doubled. Additional repair space is being built to accommodate the largest Cooper machines.

SIE announces the sale

. . . of the company's $67,000 MS-18 GeoData seismic data-processing system to Asiatic Petroleum Co., a subsidiary of Shell. The Southwestern Industrial Electronics Co. MS-18 is destined for service with Campagnia Shell de Venezuela for processing seismic data gleaned in South Ameri-

new..

"Varec" Dynamatic

HIGH ACCURACY AT LOW COST

Power Operated

liquid level

TANK GAUGE

- Accurate to better than 1/16".
- Readings in feet inches and sixteenths.
- Graduations available in metric and decimal.
- No floats, counterweights or spring balances.
- Large, easy to read numbers on dial and counter.

The *Dynamatic* Power Operated Gauge utilizes a force balance system arranged to detect and display liquid level. The measuring device consists of two elements; a force measuring element and a displacer that is a solid plate of any material suitable to the environmental conditions.

Friction—the specific gravity of the product— the load placed on the gauge head to drive accessory controls and remotes—turbulence—none of these have any adverse effect on the accuracy or reliability of the gauge.

The remarkable low cost and the high level of accuracy and sensitivity have been achieved by Varec's uniqueness of design and not by the sacrifice of quality materials and workmanship. ● *Request Bulletin CP-3705* ●

The Vapor Recovery Systems Company - Compton, Calif.

can exploration work. The system is used for presenting cross-sections of the earth's subsurface from the combined analysis of a series of seismic records.

At the same time SIE, one of the Dresser Industries, reported the sale of one of its new CM-2 analog computers to The Dow Chemical Co.'s Texas Division at Freeport, Tex. The computer is particularly suitable for use in computation of process variables and for control in chemical, petrochemical, and refinery work. Dow will use the instrument for efficiency calculations on pilot-plant operations at its Freeport chemical and petrochemical complex.

T. E. Casselman, Jr. is named

T. E. Casselman

. . . manager of Stone & Webster Engineering Corp.'s New York office, announces T. Cortlandt Williams, president. Casselman was formerly assistant engineering manager in the Boston office.

Casselman joined Stone & Webster in 1940 after working on the engineering staffs of Worthington Corp. in Harrison, N. J., Jackson Engineering Corp., Tulsa, and American Locomotive Co. in New York.

Starting as a project engineer, he worked on the design of chemical and petrochemical plants built by Stone & Webster in the United States and various parts of the world. He was promoted to chief engineer of the Chemical Division in 1956, and made assistant engineering manager 2 years later.

Maloney-Crawford realigns

. . . sales division personnel, according to W. H. Land, vice president and general sales manager. Those affected are staff members of Maloney-Crawford Tank & Mfg. Co. or Union Tank Co., which recently was acquired by the Tulsa firm.

Ed C. Kopp, former division manager for M-C, has been named vice president with headquarters in Fort Worth. George W. Smith, previously regional manager for Union in Dallas, has become division sales manager of the new organization with offices in Houston. Clint B. Warren, former M-C sales manager at Houston, is the newly named division sales engineer.

Thomas Q. Mayes has been promoted to branch manager at Houston. He had been Maloney-Crawford's assistant manager there. Mac W. Miller, who was area sales engineer for Union, has been elevated to division sales engineer in Dallas. Charles K. Gravis, engineer for Union at New Orleans, assumes the job as division sales engineer with offices in Harvey, La.

Other appointments include: Carroll T. Lancaster, branch manager at Harvey; James W. Young, branch manager at Lafayette, La.; Fran J. Hencke, branch manager in Corpus Christi; Lee O. Weaver, salesman at Midland, Tex.; H. R. Stoker, branch manager at Nocona, Tex.; and Merrill E. Bailey, sales supervisor and manager of sales in the Rocky Mountain area.

Named to branch manager posts were: Thomas E. Goodwin, Hobbs, N. M.; Fred C. McDaniel, Farmington, N. M.; Leonard L. Beck, Sterling; L. R. (Bob) Chester, Oklahoma City; and Jack J. Frese, Liberal, Kans.

Girdler Catalysts to distribute

. . . montmorillonite catalysts, developed by Sud-Chemie, A. G., Munich, Germany, exclusively in the United States and Canada.

Girdler Catalysts, a unit of Chemetron Corp.'s Chemical Products Division, will handle K-306, available in powder, granulated, or globular form for depolymerization and splitting of long-chained hydrocarbons; K-10, also available in powder, granulated, or

Get the best deal

. . . in Oil Banking!

One of the largest Oil-credit files in the nation . . . and one of the oldest, most experienced Oil-banking departments in the world . . . just —

Think . . . 1st of Tulsa SINCE 1895

FIRST NATIONAL BANK AND TRUST COMPANY
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

How they condition mud without pump *on "El Dorado"*

You never see a mud pump jetting mud on this giant drilling barge.

Yet mud is always ready as fast as it's wanted. Every gallon stays at the right weight and viscosity. Tool Pusher C. C. Parsons can get heavier mud when he needs it—*in seconds.*

LIGHTNIN Mixers keep mud flowing and mixing powerfully in the tanks of "El Dorado" as it probes beneath Mexican waters in the Bay of Campeche.

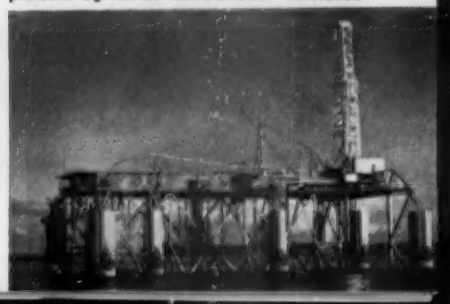
"Whenever we check, we find weight material in perfect suspension," says Parsons. "The mixers run constantly without trouble." And wear on the mud pumps is down to a minimum.

No third pump needed. Right off the bat, you start saving money when you equip your mud tanks with LIGHTNIN Mixers. On most rigs the mixers make the purchase of a third mud pump unnecessary!

From the start, you get faster drilling, too—more feet of hole per dollar invested. Mud gets into top condition fast, and stays that way. You eliminate long, costly waiting. When you need to, you can heavy up mud *in seconds.* Weight and gel additions disperse as fast as you dump them in.

See for yourself how LIGHTNIN Mixers are cutting costs, stepping up productivity on rigs near you. Your LIGHTNIN representative will gladly arrange a field trip for you. You'll find his name in Composite Catalog. Call him now—or write us.

EXPLORING Mexico's first offshore field, "El Dorado" barge is being operated by Perforaciones de Mexico, S.A., drilling contractors, for Pauley Pan American Petroleum Co., under exploration agreement with Petroleos Mexicanos.



Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-k Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

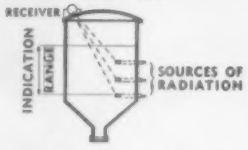
MEASUREMENT AND CONTROL UNDER EXTREME OPERATING CONDITIONS . . .

GAGETRON®

. . . for level, specific gravity or interface measurement and control in a closed vessel through nuclear radiation. GAGETRON provides permanent, efficient control and measurement under severe operating conditions in process vessels or piping. Mounted externally or internally, GAGETRON will gage levels continuously or control levels at predetermined points.

LEVEL

Multiple sources of radiation usually required to measure or control level of liquids or solids in closed vessel. Sources arranged vertically on vessel wall. Specific gravity of materials to be measured determines distance between sources. GAGETRON is used NOW for polyethylene, coke and catalyst, uranium ore and liquid ammonia level.

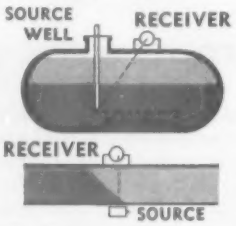


SPECIFIC GRAVITY

GAGETRON may be used to measure and control the density of materials being discharged from a hopper. The specific gravity of practically any material can be successfully controlled. Located outside the vessel, the detecting device is not affected by extreme temperatures or pressures within the vessel. GAGETRON is used NOW for specific gravity control of dextra-maltose syrup, density control on lead slurry autoclaves, specific gravity measurement of ammonia slurries containing solids, density control of asbestos cement slurry.

INTERFACE

Detection of interface position between materials having different Gamma ray coefficients can be performed ACCURATELY with the GAGETRON. Tank installations may be made either internally or externally, depending on tank design and user preference. Pipeline installations are easily made by locating source diametrically opposite the detector. GAGETRON is used NOW for interface detection of refined petroleum products in pipeline, acid/hydrocarbon interface measurement in extraction column, interface control of saturated brine/solid salt bed in evaporator, water/acid interface control in settling tank.



SPECIFICATIONS

Power: 105-125 VAC, 50-60 cps
Output Impedance: 0-500 ohms
Output Power: At 500 ohms impedance, 40 mv. at 10 counts per sec.
Variation of Output: With counting rate at 10 counts/sec. at 500 ohms and 20 sec. counter time constant is 5%. Normal operating condition; 250 ohms output at 70 cps for 40 mv. with 20 sec. time constant variation is 2%.

INSTRUMENTS INCORPORATED TULSA

INSTRUMENTS, INC.

BOX 556 • TULSA, OKLAHOMA

PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

globular form for alkylation, dehydration, isomerization, and polymerization; and KSF, KSFO, and K-10-SF, available in powder, granulated, or spherical form for more severe alkylation and isomerization.

Nelson E. Davenport is named

N. E. Davenport

. . . assistant to the vice president of Rockwell Mfg. Co.'s Petroleum & Industrial Meter Division, reports G. T. Bowman, vice president of P&I and International Divisions. Davenport formerly was export sales manager of the company's meter and valve products.

His responsibility now will primarily involve management of Rockwell's P&I business, and the sale of meter and valve products in the Canadian market.

Davenport joined Rockwell as a sales engineer in 1950, moved to Pittsburgh as assistant product manager of gas products in 1955, and assumed his most recent position in 1957. Before starting with Rockwell, he was a process design engineer with Taylor Refining Co.

Victoreen Instrument organizes

. . . an Industrial Automation Division at Bedford, Ohio, to concentrate on new applications for radiation and radiation control, announces David H. Cogan, chairman and president of Victoreen Instrument Co.

Scientists and technicians at the Bedford plant will explore effects of radiation on petroleums, chemicals, and biologicals initially, and will carry the program on to other fields.

Warren G. Parmenter appointed

. . . to manager of Walworth Co.'s plastics section, where he will be responsible for all development and related activities pertaining to plastic valves and fittings. He will also assist the manager of plastics sales in having plastic products included in industrial and municipal specifications and codes.

Before joining Walworth, Parmenter spent 6 years with Permacel Tape Corp., in Brunswick, N. J., where he served as a design engineer, product manager, and in other positions.

PESA adds two new members

. . . to the association. They are: Fort Worth Pipe & Supply Co., and Servco Co., Long Beach, Calif.

B. T. Collins is named manager

. . . of the Laurel, Miss., store of Jones & Laughlin Supply Division, announces A. G. Bastian, manager of field operations.

Collins began his career with J&L as a storeman at Laurel 7 years ago. He served in the same capacity at the division's Brookhaven, Miss., store. Collins was promoted to salesman and transferred to Laurel in 1954.

McCullough Tool Co. opens

. . . a mountain division sales office at Billings, Mont., and names R. J. Rice, assistant division manager, logging and sales promotion, to head the office. Rice, formerly stationed at Casper, Wyo., has been with McCullough the past 2 years.

Chase & Sons, Inc. introduces

. . . a new corrosion-prevention coating package to the pipeline industry. The Corr-Prev Division's package includes pressure-sensitive polyethylene tape and an overwrap, as well as other

B. M. Stephanus

D. E. Rood

products used in corrosion control of piping structures. Blaise M. Stephanus has joined Chase as marketing director of Corr-Prev. Division.

Meanwhile, Douglas E. Rood joined the division as manager of the southwest area. Rood comes from Bechtel Corp. Previously he was with Tennessee Gas Transmission Co.

Cooling Tower Institute shifts

. . . its Palo Alto, Calif. offices to Houston, according to CTI President Karl E. Johnson. Operation of the CTI programs will continue in the areas of research and in the publication of industry standards under the direction of James L. Willa, CTI manager, with offices in Houston.

A. D. (Doug) Hogan to handle

. . . distribution sales of Marine Products Co. throughout the United States. He will locate at Oklahoma City. Hogan was formerly assistant production manager for Athletic Mining & Smelting Co. and, prior to that, was with Brown Oil Tools of Houston.

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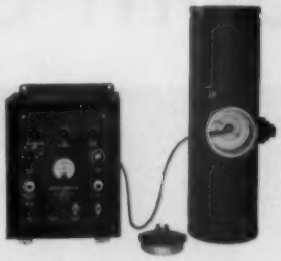

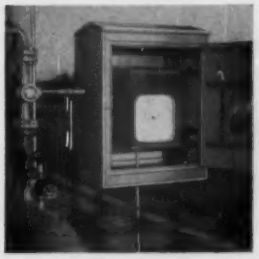

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- For continuous recording of water content in hydrocarbons
- For batch interface recording without sampling on product pipelines

Write for Bulletin CP-758

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- For indication of high or low level in closed vessel
- For interface control in closed vessel
- May be adjusted to ignore foam and react to liquid or to detect presence of foam on liquid
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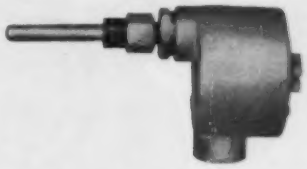
- Contains hermetically sealed DPDT relay to actuate alarm lights, horns, etc.



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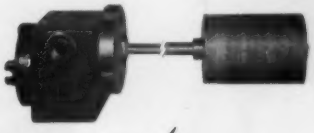

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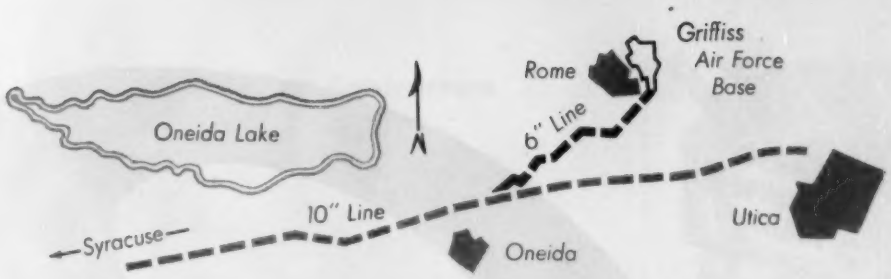
PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

Jet fuel line goes in despite snow..



....ice...frost...and mud

EARLY THIS YEAR, Buckeye Pipe Line Company installed the 11-mile spur line which now supplies Griffiss Air Force Base with jet fuel. Built with Bethlehem 6-inch electric resistance-weld pipe, the spur takes off Buckeye's 10-inch Syracuse-Utica products line at Verona, N. Y., and ends at the Air Base just outside Rome, N. Y.

Because of the urgency of the project, the contractor, Sheehan Pipe Line Construction Company, laid a good part of the line on top of the frozen ground. It was buried later when the first thaw permitted ditching. And to save even more time, the entire 11 miles was tested with product instead of water. Characteristic of sound pipe-laying practice coupled with the top-quality of Bethlehem pipe, the line tested out perfectly.

Our engineers will be glad to assist you in any way possible. Just get in touch with the nearest Bethlehem Steel sales office.

NEED LINE PIPE? *Bethlehem makes hydraulically expanded electric fusion-weld pipe from 18 in. through 42 in. OD with walls to ¾ in. in all diameters, and in 40-ft lengths; electric resistance-weld pipe from 5 in. (nom.) to 16 in. OD, in lengths to 60 ft; and continuous buttweld pipe ½ in. to 4 in. (nom.) in various lengths. Bethlehem line pipe meets the appropriate API specifications.*

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Buttoned-up rig on movie lot keeps . . .

Sound in, spectators out

A SOUNDPROOFED rig by Continental Oil Co. is intended primarily to shut out drilling noises from adjacent production studios of Metro-Goldwyn-Mayer and nearby residents. Actually, it accomplishes much more—it assures that this tight hole will really be kept tight.

Operation is Conoco 1 MGM, first well on an 88-acre lease obtained earlier this year. The oil firm also holds 55 acres under lease on the Culver City studio property of Desilu Productions, Inc. The concrete structure on the right shows proximity of MGM sound studio to the well.

New drilling-data service offered

A Calgary firm, Drilling Records, Ltd., offers a new service to drilling contractors and oil companies—comprehensive information on wells drilled in Swan Hills area. This study points up details which should prove invaluable in the drilling of future holes there.

Savings up to $10,000 per well may be effected by analyzing the compiled data. The study shows that as much as 16 days' ($20,000) difference occurred in the drilling performance of different contractors, of rigs owned by the same company, and wells dug by the same unit. Well data records were obtained from tour reports, mud records, and geological information supplied by oil companies and drilling contractors.

Lawrence Herrington, a Calgary petroleum engineer, heads Drilling Records, Ltd., and he has used his experience as a drilling and mud engineer in devising the forms and assembling the pertinent statistics where they are available now at one source. Formerly, contractors had to base their bids and drilling programs on essentially the same type of informa-

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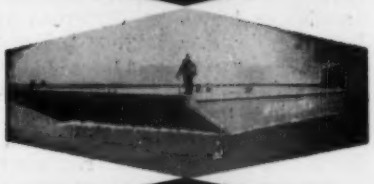

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NEW ENGINEERING DEVELOPMENT

Dowell Announces the "Acid Guide"

Now available to you—a new, greatly improved method for planning and predicting the results of oil well acidizing treatments. The "Acid Guide," developed and now in use by Dowell, offers you an engineering basis for answering these questions:

1. **Is an acid treatment advisable?**
2. **What acid treatment would be best—kind of acid, addition agents, volume, injection rates, other considerations?**
3. **What results can I expect?**

Field results show an amazingly high degree of correlation with answers calculated from the "Acid Guide." You get this sort of information only from Dowell.

Today, when you ask your Dowell representative to **engineer** an acid treatment with the aid of the "Acid Guide," the chances are good that he will recommend an entirely different treatment than you expect. Acid volumes may be either smaller or larger. A different kind of acid may be recommended. Higher injection rates may be considered. As a matter of fact, the Dowell engineer may recommend fracturing or other treatments instead of acidizing.

In any case, field results indicate that you are likely to get more profit from your acidizing dollar.

Key to the "Acid Guide" is an "acid index number" which varies with the formation and the type of acid. Using this number as a basis, it is possible to select the most efficient treatment and to predict the probable results. The idea is to open up the largest possible drainage area at the lowest possible cost—by giving you the deepest possible penetration of the acid before it spends. This is achieved by balancing the amount and kind of acid and the injection rate against the solubility of the formation.

For example, Dowell engineered a treatment for a well completed in the Strawn Lime of Midland County, Texas. This formation is found at about 11,000 feet and is tight, dense, and almost completely soluble. The well did not produce at all after perforating. 360 gallons of BDA* (Breakdown Acid) was applied to clean the face of the pay, and production went to 27 bopd. The allowable is 180 bopd.

The "Acid Guide" showed that, under the existing well conditions, the optimum treatment was 12,000 gallons of Retarded Acid. It also showed that the maximum amount of regular acid that would be helpful was 2,000 gallons. The operator elected to treat the well with the 2,000 gallons of regular acid. Production rose to 53 bopd. Because of these results, the operator decided to try a 4,000-gallon regular acid treatment. However, as had been predicted with the "Acid Guide," there was no further increase in production.

Then the operator decided to follow the "Acid Guide." 12,000 gallons of Retarded Acid was injected at 5⅓ bbls. per minute. Production rose to 84 bopd. **The $3,500 cost was paid out in two months.**

That is just one example of the way the "Acid Guide" is increasing profits for operators. This engineered approach to acidizing is available only from Dowell, and is provided to you at no extra cost.

For detailed information or service call the Dowell station or office nearest you. Dowell has more than 165 service points in the United States, Canada, Venezuela, and Argentina. Dowell, Tulsa 1, Oklahoma.

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J. P. Murphy, General Manager, Denver

tion that Drilling Records offers—but they had to go to several sources and the information was not always available or complete. Bid records came from bit suppliers; mud programs came from mud firms; and technical data such as bit weight, number and size of collars, tests, logs, coring, lost circulation zones, time losses due to fishing, stuck, rig service, etc., came from sundry and irregular field reports.

The new service will afford greater efficiency to the analytical cost-conscious contractor. He will be able to anticipate his needs to overcome likely problems. In short, he should be able to drill more hole faster and cheaper with complete advance information.

Presently, Herrington offers records on Swan Hills only. Proposed plan is to compile drilling records for other Canadian fields.

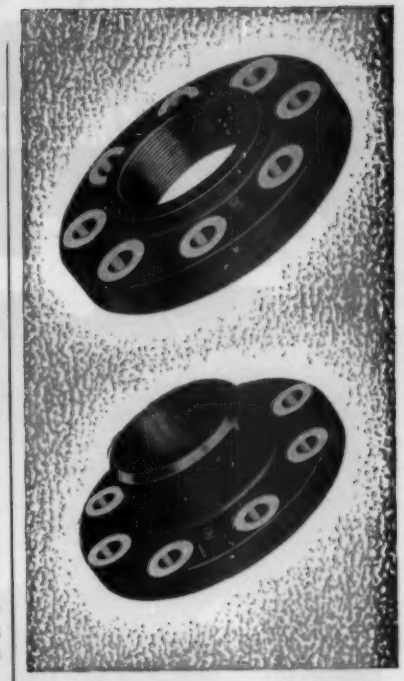
The coverage of each drilling record which is offered to the contractors and oil firms on a subscription basis will include the following:

1. Time analysis—a breakdown between day work and contract days. Day work includes testing, coring, logging, lost circulation, completion or abandonment. Contract days are divided into rotating, tripping, running casing, stuck or fishing, mechanical down time, conditioning hole, rig service, waiting on cement, etc.
2. Mud types and depths run.
3. Number of drill collars.
4. Bit weight and rotary speeds.
5. Hole deviation from vertical.
6. Pump pressures.
7. Significant formation tops.
8. Drilling time in feet per bit and feet per hour.
9. Graphs, three for analytical comparison showing: total time on well versus depth, contract time on well versus depth, and rotating time on well versus depth. In addition, these graphs signify any trouble recorded on the tour reports.

Swan Hills is a logical place to start compiling complete data. By year end for the entire area, it is estimated that wells will total 80, at a cost of $16,000,000.

True acquires Reserve

After 14 years in contract drilling, Reserve Drilling Co., Casper, Wyo., has been sold to True Drilling Co., according to H. A. True, Jr. The surviving firm will operate nine rotary rigs and under the terms of the acquisition will retain all former personnel. Offices will continue in Casper.



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Again, Core Lab research rings the technological bell!

For the first time since the advent of gas chromatography in mud logging, here is an electronic system that answers all field requirements.

Simple in design and operating principle, the new and versatile Programmed Hydrocarbon Detector provides super-sensitive detection and analysis of *total* gas. Not simply one, or two, or three hydrocarbon components but *all* fractions present — including the heavies. And you can monitor the components in rapid-fire sequence — either singly or in various combinations.

P/H/D, utilizing a Core Lab-conceived "back flush" technique, automatically analyzes and records methane only, plus heaviers, in 90 seconds; methane and ethane individually, plus heaviers, in 120 seconds; methane, ethane, and propane individually, plus heaviers, in 180 seconds; etc. The range from methane through pentanes can be completed in six minutes!

A *single* continuous recording is cleaner and sharper with taller peaks — making the heretofore "lost" heavier hydrocarbons easy to discern.

P/H/D is built the way rig-side service equipment should be built — sturdy, compact, and with no complex maintenance problems.

P/H/D is not merely an untested drawing-board project. It's ready *now* to help you find more oil.

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Exploration breaks its leisurely pace in the land of

Moss, Magnolias, and oil

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	RODESSA	GLEN ROSE ●
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JURASSIC	COTTON VALLEY ● BUCKNER SMACKOVER ●	

BY PETER BIKE

BY MANY standards Mississippi is a good place to look for oil. The search continues in cyclic spurts. Following a drilling flurry, activity drops off to a quiet lull, only to resume again with another surge. Today it's on the crest of the wave again. Why?

Here's why:

- Comparatively little hard digging is encountered.
- Mud problems are nil at depth.
- Few crooked holes are drilled.
- Over-all costs here are generally lower than for similar depths elsewhere.
- One-well fields are a rarity.
- Producing targets are usually multipays.

Perhaps the only deterrent is the present success ratio, which lags behind the national average. Out of 199 wildcats launched to mid-September, 183 were scuttled for a .080 batting average. In total operations, the picture is brighter, with 254 successful completions out of 450 starts. This encouraging 56% is due largely to development work at such fields as Little Creek, Bryan, Pistol Ridge, and Raleigh. Little Creek alone is rapidly approaching a 100-well field and the end isn't in sight yet.

The trend is for deeper drilling with special emphasis on the Lower Cretaceous and Jurassic sections. There are several salt domes in the state which warrant further evaluation. It is expected that these will be checked to determine their true potentials. A glance at the stratigraphic column shows that the Paluxy, Rodessa, and Cotton Valley will be the prime targets for deeper probing. Previously, the Eocene-Wilcox and the Upper Cretaceous - Eutaw and Tuscaloosa formations have accounted for much of the production in more than 50 fields in Mississippi.

Oil in many formations . . . The tally so far is 16 new fields and important new-zone stepouts. Whether some of the outposts are associated with shallower existing production will be determined by future exploitation.

In Adams County three discoveries —Gallilee, West Deerfield, and Southeast Fairview—have produced oil in the Wilcox-Eocene sand.

Upper Cretaceous strikes were made in the Tuscaloosa at Summit in Pike County, at Little Creek, McComb, East Dexter, Sweetwater in Lincoln County, and West Lincoln. The Paluxy and Lower Cretaceous-Mooringsport paid off at Merit in Simpson County. And Morton, in Scott County, also was a Eutaw find.

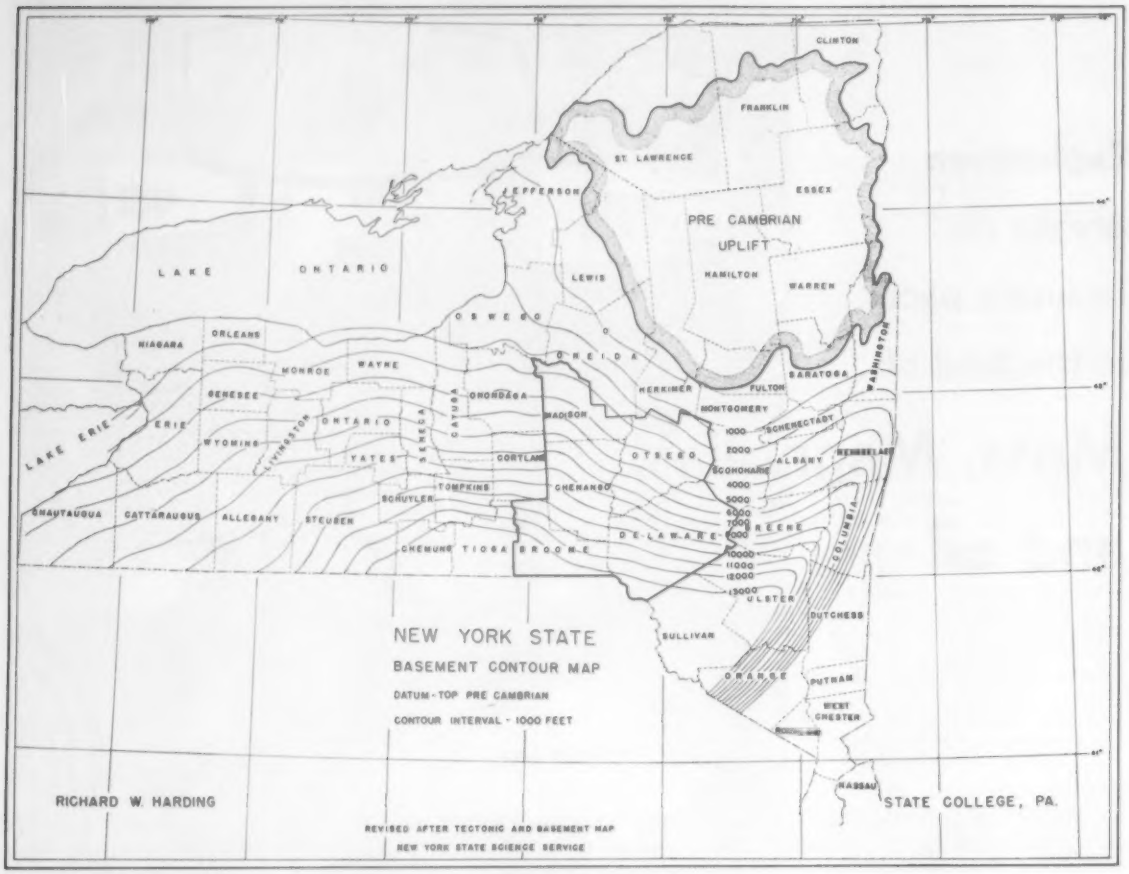
Sectors producing from the Lower Cretaceous beds include Laurel (Paluxy) in Jones County, Grange (Mooringsport) in Jefferson Davis County, and Heidelberg (Rodessa) in Jasper County. Jurassic beds promise to provide a lot more Mississippi oil. At Heidelberg, for example, the Cotton Valley flowed at a rate of 212 bbls. per day on a small choke from 11,238-48 ft. and was shut in.

Significance of Jurassic oil . . . Before the Cotton Valley oil, Heidelberg produced from Eutaw and Tuscaloosa. Other than the Gulf Oil Corp. discovery at Soso in 1958 from the Cotton Valley, Heidelberg is the only field with commercial oil from that zone.

A yet deeper Jurassic pay is indicated in Smackover in Scott County. The California Co. 1 Forkville Unit tested Smackover oil at various intervals below 13,300 ft. The oil was water-cut and later deemed noncommercial. This points to Smackover oil as a definite possibility. Loring field, 30 miles to the northwest produces Smackover gas. The California Co. venture indicates that under more favorable conditions the Smackover can produce oil.

Mississippi has a long way to go before its oil possibilities are realized. Ranked eighth today in daily oil production, it is likely to rise to a more prominent position.

FIG. 1



Here's a look at the basement map that points to . . .

New York—a real sleeper

BY RICHARD W. HARDING

THE SOUTHERN-TIER counties of the south-central part of the State of New York have been sorely neglected since the days of Titusville in 1859.

Presently, intense exploratory efforts are being directed toward our largest state, Alaska. This is justifiable. The writer does not intend to detract from, nor underestimate the national importance of, the potential crude-oil and natural-gas resources which undoubtedly will be found within this immense area.

Exploratory drilling on an international basis is assuming large proportions and appears to be of a somewhat sporadic nature, when we consider that wells have been drilled in such places as the Philippine Islands, Cuba, Australia, and Iran. This emphasizes the global aspect of this activity. Each of the preceding oil provinces has its own sedimentary basins, and certainly none of them were tested with the drill before exhaustive geological study and full cognizance of the economic aspects.

Why has the backyard of the birthplace of the industry been bypassed and seemingly forgotten for so long? This is even less understandable when we realize that South Central New York is located geographically on the immediate fringe of the largest industrial market in the United States. Petroleum products, especially natural gas, find a ready and demanding market at premium prices in this great industrial area.

South Central New York eventually may prove to be a sleeper. One possible explanation for the utter lack of exploratory activity within the area may be that after Drake's discovery in 1859 and the closely following de-

THE AUTHOR has wide experience in exploration problems over much of the U. S. and Canada. Previous assignments have sent him to the oil provinces of Texas, Louisiana, Mississippi, Oklahoma, Pennsylvania, and New York. Richard W. Harding is currently a staff member of Pennsylvania State University in the Mineral Industries Continuing Education Department at State College, Pa. He also is a consulting geologist engaging in oil and gas exploration in the Appalachian basin. His former affiliations since 1943 include: Heiland Exploration Co., Shreveport; Quaker State Oil Refining Corp., Bradford, Pa.; and Skelly Oil Co., Shreveport. Harding received his BA degree, major in geology, from Lafayette College, Easton, Pa., in 1943.

velopment of the western Pennsylvania and New York oil fields, oil discoveries, excitement, and wild hysteria followed in close succession in a south and westward direction.

It is true that the Appalachian basin has had recurrent exploratory activity in recent years; nevertheless, this activity again has been directed toward the total development of major structural features, many of which previously had been considered to be barren—until some independent proved otherwise!

Regional Geology

The south-central portion of New York embraces five counties; namely Madison, Delaware, Otsego, Chenango, and Broome in an area comprising approximately 4,762 sq. miles, or 3,047,680 virtually undrilled and untested areas. Perhaps this fact, together with the recent gas development to the immediate southwest in Central and North Central Pennsylvania, is sufficient evidence to tempt several of the major oil and gas companies to review again the northern end of the Appalachian basin.

One major oil company is reportedly leasing large blocks of acreage at $1 per acre in counties immediately adjacent to the western fringe of the subject area (Fig. 1). Undoubtedly this is designed as a broad regional play intended to test, eventually, the entire sedimentary section with major emphasis being placed on possible reservoir beds and stratigraphic-type accumulation.

Sedimentary Section

The map (Fig. 1) indicated the thickness of the sedimentary section encountered throughout the State of New York. It is indicative of the depth to the basement complex, which is composed of crystalline rock. Thus no oil or gas production would be anticipated below the contours indicated on the map.

The map should not be construed as representative of any structural configuration beyond that of a broad, regional nature. It shows, rather, merely the Precambrian crystalline rock outcrop in the northeastern part of the state and the highly folded, metamorphosed rock section paralleling somewhat the Hudson River valley in the eastern part of the state. The important feature to note (Fig. 1) is the rapid rate at which the sedimentary basin dips to the south and to the southwest away from the Adriondack uplift. This rate of south to southwest regional dip approximates 50 ft. to the mile in the northeastern part of the map area adjacent to the outcropping igneous mass, and increases

" . . . a broad regional play is intended to test, eventually, the entire sedimentary section with major emphasis being placed on possible reservoir beds and stratigraphic-type accumulation."

to approximately 175 ft. to the mile in South Central New York adjacent to the Pennsylvania state line. It is in this latter region that the northern Appalachian basin plunges most rapidly.

This rate of structural depression also is accompanied by a considerable increase in the thickness of several of the stratigraphic components of the geologic column. It may be determined from inspection of Fig. 1 that the thickness of the sedimentary beds increases from zero over the south flank of the Adirondack uplift to more than 13,000 ft. in the southern part of Broome County, near the New York-Pennsylvania boundary. The subsurface control available for Fig. 1 is limited by the paucity of past drilling activity. The contours are based on key wells which have penetrated the basement complex and which are located at widely separated intervals throughout the state. In the area under discussion, it is expected that from 5,000 to 11,000 ft. of predominently marine sediments lie unconformably on the top of the Precambrian basement complex.

Stratigraphy

The stratigraphy of the immediate area embracing South Central New York is shown in Fig. 2. This is a generalized, diagrammatic, north-south cross-section which begins somewhat south of the outcropping igneous Adirondack uplift and continued southward into the deeper part of the Appalachian basin.

The writer has made no attempt to correlate this cross-section with structure. The section has been constructed independently of wellhead elevations or other datum planes. The prime purpose of the cross-section is to show the sedimentary column as it occurs from the ground to the Precambrian basement complex. Particular emphasis is placed upon the shallower Devonian beds, the main producing horizon of southwestern New York and northwestern Pennsylvania.

Sequence of beds . . . As the stratigraphic section (Fig. 2) is followed basinward, it is noted that progressively younger beds outcrop at the surface. This increases the thickness or depth to the basement throughout the subject area. More important to note is that this over-all thickening indicates potential reservoir beds with accompanying lenticular or stratigraphic-type traps that might be found in these progressively younger sediments. These could be reached with the drill at considerably lesser depths than would be required for those in Central Pennsylvania.

Although not interpreted primarily as a structural section, Fig. 2 does demonstrate the major structural depression in that the sediments conform with a gentle south to southwest regional dip away from the Adirondack uplift. South of Well 2 the basement rocks plunge sharply into the Appalachian synclinorium with an accompanying increase in total thickness of the marine sediments deposited over the north flank of the basin.

The thickening of the entire geologic column is not due alone to the addition or sequence of the deposition of the more recent sediments. There are several stratigraphic horizons which show a tendency to increase in thickness (or thin) as the section is followed southward. There are many stratigraphic horizons, particularly within the Devonian, which lens or pinch out entirely. These will be mentioned briefly later. It is intended to point out to the reader that major stratigraphic changes occur—rather than to delve into the reasons for such changes. The latter could be the subject for an exhaustive research study.

No attempt has been made to identify the various horizons of the Devonian. The Upper Devonian is the major oil-producing section of western New York and Pennsylvania. The Middle Devonian-Onondaga limestone and Lower Devonian-Oriskany sandstone formations are major gas-producing horizons of these two states. Most of the Devonian sands, shales, and limes are lenticular in the extreme. The sparse well control available over the area discussed makes it virtually impossible to correlate and identify each and every formation member of the Devonian, even though the Devonian section is recognized as being a most important one from the standpoint of future production. It is seen in the cross-section (Fig. 2) that the Devonian thickens southward due to the addition or deposition of younger beds, and to the increased thicknesses of individual members within the Devonian.

The Silurian underlies the Devonian, and an attempt has been made on the cross-section to identify the more

"The interesting fact remains that the Theresa sandstones obviously possess satisfactory porosity and permeability in this area."

prominent Silurian members. Note that the Camillus shales remain practically uniform throughout the subject area, thinning perhaps at the location of Well 4. The Vernon shales appear to thicken considerably beginning at the point where the basement rocks plunge most rapidly into the basin. The Lockport shale apparently pinches out in a northward direction. The Lockport is present as a shale member in Well 2 with an increased thickness in Well 3. At the location of Well 4 the Lockport has thickened considerably and has assumed more the lithology of a limestone. The Clinton sands and shales, like the Devonian, are lenticular in the extreme. No effort has been made to identify individual formation members, even though one of them, the Medina, is a major gas-producing horizon in western New York.

There are several formation members of the Clinton which are potential reservoirs in the area. In the writer's opinion, the most favorable member would be the basal Silurian-Oneida conglomerate. The Oneida is a lenticular zone. It was very well developed in Well 3. There was no reference to the Oneida in the literature describing Well 2 and it is assumed that the Oneida pinches out northward before reaching this well. The Oneida was responsible for a show of gas at Well 3.

Over-all Clinton thickness appears to remain relatively constant in this area. A slight basinward thickening and probable change in lithology is evident. From the northern sector progressing basinward, the sands grade into compacted sands and shales.

Ordovician members indicate the greatest degree of sedimentary thickening. Wells 1, 2, and 3 penetrated the entire Ordovician section. The southernmost well (4) failed to penetrate the Ordovician. Ordovician thickness and lithology in this area have been assumed as shown. This assumption may be valid because the Appalachian basin plunges abruptly between Wells 3 and 4. There has been appreciable thickening in the Ordovician between Wells 2 and 3. It is reasonable to assume that this degree of thickening continues southward towards Well 4.

Upper Ordovician consists of two extremely thick shale formations, the Frankfort and the Utica. Both of these formations are composed of dark gray to black argillaceous, marine shales. It is the general belief that these shale beds have many of the requisities of excellent hydrocarbon source material. It is recalled that the immediately overlying Oneida conglomerate had a show of gas at Well 3.

Immediately underlying the Utica shale formation is the Trenton limestone which has been found productive in western New York. The Trenton is composed of light gray to medium grayish-brown, massive limestone. Locally it is dolomitic and contains some chert. Porosity and permeability appear to be the major factors controlling the accumulation of gas and oil within this zone.

The Beekmantown, underlying the Trenton, is a white to light gray, hard, crystalline limestone, generally dolomitic, and contains clear, angular quartz fragments locally. No production has been obtained in New York State from this horizon. However, it should not be overlooked, since porosity and permeability also would be a controlling factor in the accumulation of oil or gas.

The Tribes Hill, basal Ordovician, consists of white to medium gray dolomite. At Well 3 the Tribes Hill contained much white chert near the top together with some rounded, frosted quartz grains. Basil Tribes Hill was quite sandy. No production has been encountered from the Tribes Hill. Like the overlying Beekmantown, it should be accorded careful attention in future explorative efforts. Favorable lithology and positive structural configuration may possibly point the way to future production in both these zones.

The Cambrian in South Central New York is composed of three prominent members: the Little Falls dolomite, the Theresa formation—occasionally referred to as the Passage beds composed chiefly of dolomitic and calcareous sandstones, and the underlying Potsdam formation which is composed of clear, angular quartzitic sandstones. The combined thickness of the three Cambrian formations in South Central New York is approximately 275 ft. at Well 3. The Cambrian is not commercially productive in the State of New York. The writer thinks the upper part of the Cambrian, the Little Falls dolomite, presents rather poor characteristics for potential reservoir beds because apparently it possesses a negligible degree of porosity and permeability due primarily to secondary dolomitization.

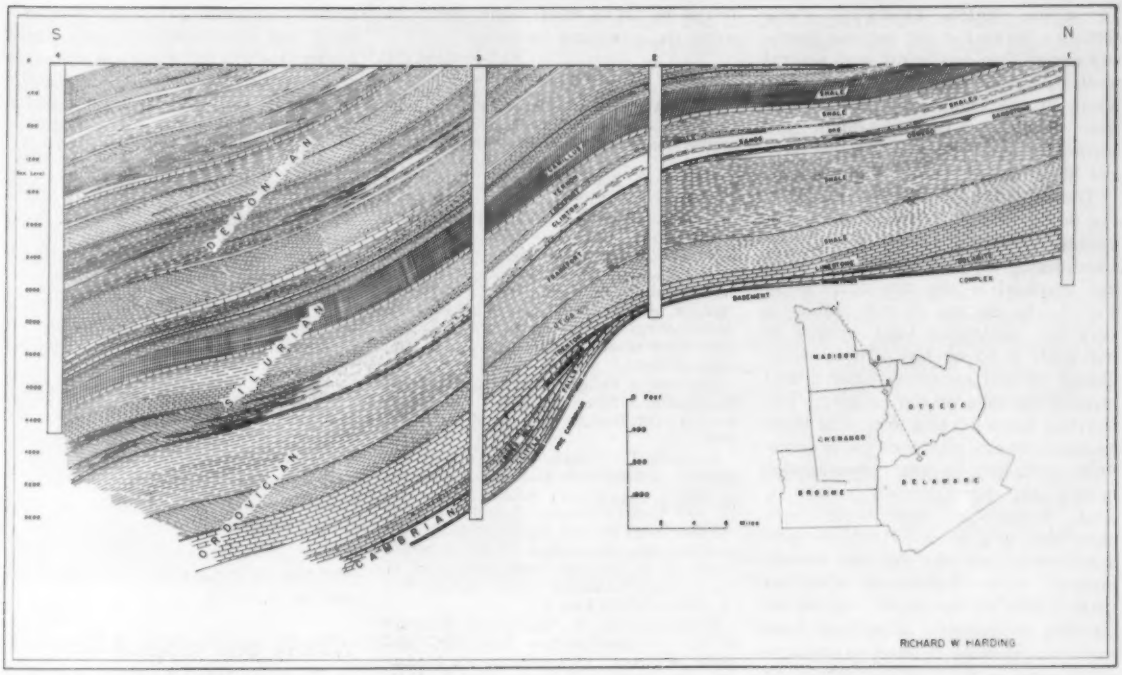
The Theresa and underlying Potsdam, on the other hand, present excellent reservoir characteristics. Porosity and permeability obviously exist at the location of Well 3 since water was encountered in the Theresa sandstone beds at the following depths: 4,693; 4,696; 4,701; 4,704; 4,782; 4,808; 5,088; 5,165; 5,180; 5,192, and 5,246 ft.

These shows reportedly were fresh water. This presents an interesting problem in speculation as to the source of the water. One possible explanation for this occurrence might be found in horizontal migration through fault zones, fissures, and fracture planes which occurred radially around the perimeter of the Adirondack uplift during its movement and subsequently after the movement during a period of readadjustment of the sediments.

The interesting fact remains that the Theresa sandstones obviously possess satisfactory porosity and permeability in this area. Favorable structural or stratigraphic-type traps within this zone may exist somewhat south of the above mentioned Well 3 and also south of the possible fracture zone caused by the Adirondack uplift. No shows were reported in the underlying Potsdam, but this horizon certainly should be accorded due care in future exploration efforts, since it has been found porous and permeable in other localities.

Inspection of the diagrammatic cross-section suggests that the Cambrian thins appreciably in a northward direction from Well 3 to Well 2. This may be due in part to the anticipated basinward thickening characteristics south of Well 2. It is possible also that the Cambrian may thin northward due to a possible pinchout over sharply rising structure, if it exists. The possibilities of structural configuration will be mentioned briefly later. The Upper Cambrian Little Falls dolomite thickens appreciably north of Well 2 toward Well 1 on the section. This anomalous condition may be due to a facies or lithologic conditions. Another possibility is an erroneous interpretation of the stratigraphic sequence since only a limited amount of information is available for Well 1. The underlying Theresa sandstones apparently have lensed out. This condition also may be applied to the Beekmantown limes and to the Tribes Hill dolomites (Ordovician).

The writer does not propose in the short scope of this paper to discuss fully the sedimentary problems and accompanying facies changes which exist within the subject area. Nor is it the purpose here to discuss at length the many horizons and stratigraphic equivalents reaching from the Devonian to the Cambrian for which authenticated oil and gas shows have



STRATIGRAPHIC SEQUENCE of beds in South Central New York. This is a generalized diagrammatic north-south section showing four tests from which data was used. Fig. 2.

been reported in localities to the west of the subject area. However, in passing, mention should be made of one additional prominent zone, the Oswego sandstone of the Upper Ordovician. At its outcrop near Oswego, New York, this sandstone has the characteristics of a graywacke and is about 150 ft. thick. Wells drilled south of the outcrop belt in southwestern New York State have encountered the Oswego as a well developed quartzitic sand. The Oswego is missing in several of the deep wells of western New York. This may be due either to lithologic or facies change or possibly to nondeposition. It is believed generally that a distinct facies condition is prevalent within the Oswego formation. When more wells have penetrated this horizon and additional information becomes available, the Oswego sandstone should prove to be a splendid target for stratigraphic-trap-type exploration.

Structure

The regional structure of the State of New York has been discussed briefly and has been diagramed in Fig. 1.

As mentioned previously, Fig. 2 is not intended as a structural cross-section. Rather, it has been simplified as a diagrammatic stratigraphic section. From a structural standpoint, one feature of the cross-section is evident. In a relatively short distance trending south and basinward from Well 2 to Well 3 the subsurface structure plunges abruptly. This feature perhaps may be due in part to the existence of a controversial Precambrian arch extending southward from the Adirondack uplift. Regardless of the academics or the cause of this major depression to the south of Well 2, the feature contains several worthwhile oil possibilities.

The area confined between these two wells is broad. It is not without reason that smaller structures would be found between these two wells. Consider the possibilities of an updip pinchout of a potential reservoir bed over such a structural feature. Consider further the possibilities inherent in a reversal of the prevailing south regional dip resulting in a closed dome. These are but two of the more obvious possibilities.

In order to carry on any intelligent and methodical exploration program within the subject area (Fig. 1), it is imperative that the structural geology be based on a localized level. It is unfortunate indeed that no small-scale localized structural map can be included here. The structure of this area probably has been mapped previously by every known mapping or explorative method. Some of this work has produced accurate and reliable structural information. Other work has not been too reliably interpreted. All of the work has been done in piecemeal fashion by various groups representing myriad interests. The greater part ofthe known structure of the area, obtained in recent years through seismic methods, airborne magnetometer, surface parties, etc., is held as confidential data in company files. This is justifiable, but unfortunate. In recent years the New York State Science Service has instituted what is hoped will be a continuing program of surface structural mapping in South Central New York. This work will be released to the public at various intervals during its progress.

It is the writer's firm opinion, based on personal work and other source material, that there exists within the confines of the subject area anticlines having structural relief of from 200 to 300 ft. as mapped on the surface. Probably the magnitude of this relief will increase with depth to the various potential producing horizons. The axis of these en-echelon anticlines is north-south. Also, it is possible that several of the more prominent anticlines may demonstrate a reversal with north dip resulting in closed domes large enough to form structural traps.

In substantiation of favorable structural configuration or stratigraphic type accumulation together with positive sand characteristics; i.e., porosity and permeability, it should be mentioned that a Pennsylvania-based company has successfully completed several wells to a depth of about 1,650

ft. in the Middle Devonian. These wells are located at the extreme southern end of Oneida County with several wells lying in Madison County just south of the Oneida-Madison county line. Both open-flow potentials and geological data of these wells have not been released yet by the operator.

During the preparation of this paper the writer searched several old publications of the State of New York. Considering the vast amount of acreage involved in the five counties in Fig. 1, the density of old drilling is very low. Estimated total number of old wells is 15 or less. These wells, almost without exception, were drilled around the turn of the century. The startling feature is that several of them encountered and produced gas in quantities sufficient to heat greenhouses, homes, etc., for extended periods of time. Remember, these wells were completed in 1890 to 1910 from open hole which then was the only known method. Most of the wells were less than 1,500 ft. in depth. It is interesting to speculate as to how these wells would have reacted to modern completion practices. Speculating further, what might have been encountered if these wells had been drilled deeper in a favorable structural location?

In summary . . . This area could not be located more favorably from the standpoint of potential markets. The area is served by an extensive network of fine highways, secondary roads, and several railroads which provide easy access for equipment. Adequate high-pressure gas-transmission lines provide an immediate outlet for future gas production.

Geologically this area has myriad inherent potentialities. The structural and stratigraphic aspects have been discussed briefly. Those contemplating exploration in the northern part of the Appalachian basin should seriously consider the following factor: the area (Fig. 1) presents the only part of the large Appalachian basin where all sediments from Devonian to the Precambrian basement complex may be penetrated at depths less than 8,000 ft.

Reservoir beds obviously exist within the area. Due to the lack of up-to-date information and the little past drilling activity it is apparent that reservoir characteristics favorable for oil and gas accumulation must be found at greater depths than previously drilled. Stratigraphy, facies changes, and other factors will be the key to future success here. Both major and minor structural features appear to exist. The minor flexures increase in amplitude with depth. These producing targets undoubtedly will be found by those who really desire to solve the problems involved.

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Another Red Cave hit for Panhandle

AN IMPORTANT addition to the prairie-fire shallow Permian play in the northwestern Anadarko basin is H. F. Sears 1-A Paramount, ½ mile west of Sanford in Hutchinson County, Texas Panhandle (OGJ, Sept. 28, 1959, p. 144).

Red Cave (Tubb sand) gas production is reported at this wildcat in Section 82, Block 46, H&TC Survey. The shallow gasser is inside the oil-producing area of Panhandle field. It is shut-in for potential test after getting up to 3 M.M.c.f.d. from 25 ft. of pay zone. Hole was drilled to 1,612 ft., casing set at 1,545 ft. for open-hole completion.

This new strike is 30 miles southeast of a Red Cave discovery completed earlier this year at Shamrock 1 Brown. Sears reports plans for an active development of the Red Cave potential soon.

New well completed in Texas' Duval

A newly completed well in the East Peters area of western Duval County, Southwest Texas, is rated good for 205 M.M.c.f.d. of gas, open flow. It is one of the largest gas wells ever completed in the area.

The well, drilled by Texo Oil Corp. and associates on their Peters gas unit, is productive from a 40-ft. section of Yegua sand at 3,260-3,300 ft. Pay is perforated at 3,262-68 ft.

Hole was drilled an additional 400 ft. to 3,679 ft., getting promising oil showings in the Bruni sand. Casing was run only through the Yegua gas zone at 3,331 ft.

Wilcox pay tapped in Texas' Webb County

Wilcox gas-condensate production being developed on the huge Pescadito salt dome in Webb County, Southwest Texas, has been established in a newly completed wildcat 4 miles south of the nearest of two wells previously brought in.

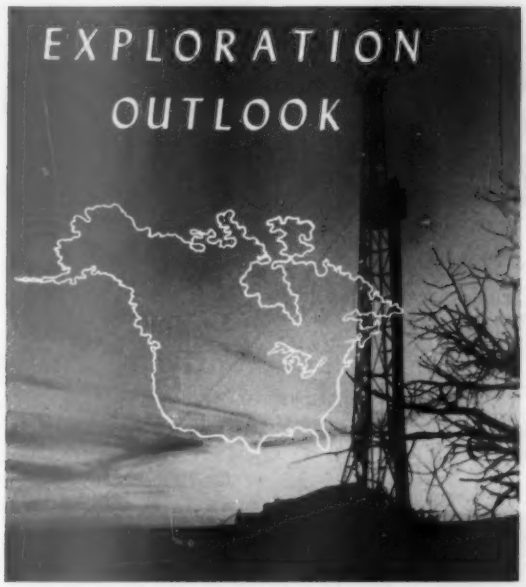
The new discovery well was drilled by Ginther, Warren & Co., Gulf Oil Corp., and Michel T. Halbouty, the same group of operators who have been developing the Wilcox area farther north, and who, in addition, have put down two ultradeep wildcats.

It is their 1 A. M. Bruni Estate, in Porcion 28.

NEXT WEEK

The geoacoustic spectrum

We'll show development of a porosity chart and the need for logging the full spectrum of the economic section



A year for the map watchers

This year's exploratory race is going into the last lap with wildcat completions up over last year, but with the success ratio falling slightly behind. Up to the middle of September 13.9% of the 6,790 wildcats completed this year were successful. This compares with 14.34% of the 6,567 drilled during the corresponding 1958 period. At the current level of drilling, these figures won't change too much by January 1. But the figures show a trend that, although not new this year, has accelerated—a trend toward more deep, remote, and daring exploration.

Exploration in 1959 has been widspread. It has been one of the most bold wildcat programs on the continent in many years. It hasn't been confined to any particular area, but several provinces do stand out over others. For those who put red pins on wall maps it's been a banner year. This year's wildcat nests will be signal spots to watch in the coming months. Here are a few for the map watchers:

Mid-Continent exploration intensifies

. . . as explorers move into new wildcat terrain, rebound into older areas, and cash in on some of the best new oil and gas finds in recent years.

During the past few months we've seen one of the most successful wildcatting treks in the Mid-Continent's long oil and gas history—the push into northwestern Kansas and southwestern Nebraska. This new Pennsylvanian province had nothing 18 months ago. Today half a dozen counties in the two states are boasting big new oil fields, a rash of new locations, and confirmation drilling.

Northwestern Oklahoma and the Texas Panhandle continue to pile up big success ratios in both wildcatting and field-development work. Although the big target remains the Pennsylvanian, an entirely new rock section is under scrutiny in both Panhandles and in southwestern Kansas: the Council Grove Permian, a shallower gas pay than the old standby Hugoton field zone. This pay appears headed for a real play in coming months.

. . . in oil-dry basins. There are no discoveries yet, but a large east-west basin, the Palo Duro, is getting a big play this year. This Texas Panhandle feature has one producing area at its west end, a few at the east end in Oklahoma, but nothing really significant. However, more wildcats have been going down in the basin this year than at any other time. The play extends across the Texas portion of the basin into the Tucumcari embayment in eastern New Mexico. Dry holes don't seem to bother those looking for oil and gas, so the search goes on. This is a basin to watch.

Texas' deep Edwards trend

. . . is on the move. A recent oil discovery in Karnes County set off a new flurry of exploration on the northeastern extension of the deep trend. Fashing field was the northeasternmost point on the deep trend until Brazos Oil & Gas Co. jumped 20 miles to the northeast. Watch for fill-in exploration between these two areas and beyond. Brazos' well is the first oil producer on the deep Edwards trend.

Look south in Williston

. . . to South Dakota's big year. This is going to be this southern anchor of the basin's record drilling year. After several years of near-sleep, exploration has picked up in the northwestern corner of the state. Drilling activity is at its highest level yet. Half a dozen new oil wells have been completed this year as operators strive to ascertain what the southwest corner of Williston holds in the way of oil reserves. This is a long-needed, interest-packed campaign. Harding County should have some more oil fields before the year is out.

Mountains and foothills

. . . will figure highly in coming exploration. There is a definite new advance into gas prospects in southwestern Alberta's Foothills belt and northwestward along the Rocky Mountain front. Areas to watch are Brunt Timber and Lookout Butte in Alberta.

The recent Arctic Circle gas discovery in the Yukon is probably the exploratory highlight of the year in Canada. This strike will be followed by more and extensive exploration throughout the north country next yar. Northeastern British Columbia will get down to business again in a few weeks with the freezeup to further evaluate last winter's big finds at Kotcho Lake and Petitot River.

A wait-and-see business

. . . is exploration, but discoveries of 1959 should set the stage for some real surprises next year. The trends are there. There will be some dry holes, but there will also be some oil and gas found. We look for one of the industry's most important wildcat years.

—John C. McCaslin.

One down, one going, one planned as . . .

Explorers look north to the Arctic

THE CONTINENT'S most northerly wildcat may be drilled next summer. Northern Affairs Minister Alvin Hamilton announced in Ottawa that a company is considering moving its drilling rig by air or sea to Cornwallis Island, about 1,700 miles north of Winnipeg and 800 miles from the North Pole.

Hamilton declined to name the company but it is believed to be Round Valley Oil Co., Calgary, which is affiliated with Lobitos Oilfields Canada, Ltd. The company holds most of the acreage on Cornwallis—1,500,000 acres—and has been conducting geological work on the island this summer.

A. Bryce Cameron, president and general manager of Round Valley, said in Calgary that the company is "thinking about drilling a well on the island."

Hamilton, following a tour through western Arctic points, said there has been much faster development progress than anticipated for the Far North.

Scurry-Rainbow Oil, Ltd., is presently moving drilling equipment inside the Arctic Circle, about 18 miles west of the Mackenzie River. This will be Canada's most northerly wildcat until—and if—the Cornwallis wildcat is drilled.

A busy summer . . . Round Valley officials said three geologists, two pilots, and two Piper Cub airplanes have been engaged in work on the island this summer. Cameron described their season as "successful" and said much would depend on the results of their work when the decision is made on whether or not to drill.

In the meantime, Hamilton reported he has ordered bulldozers to jump ahead on the oil access road being driven 200 miles from Flat Creek in the Yukon, just below Dawson Creek, northeast to Eagle Plains plateau near where Western Minerals made an encouraging strike.

The oil companies seem to be interested in a government offer to split costs 50-50 on air strips in the north, he said. He then made reference to the projected drilling plans for Cornwallis Island, which lies in the zone where an intensive rush for exploration permits centered earlier this year. Applications have stabilized at 95,000,000 acres, with none granted as yet—although 1-year permits have been handed out to some firms.

Cornwallis Island is the site of Resolute Bay, supply-distribution center for the central archipelago with a permanent weather station and the most northern RCAF base in the country. Seams of coal up to 5 ft. thick are among favorable geological features of the island.

More Yukon gas? . . . There were reports in Calgary of a new pay zone at Western Minerals, Ltd.'s, recent oil-gas discovery in the Yukon Territory. Details are not available, however.

The 1 Chance discovery well flowed up to 10 M.M.c.f.d. and light-gravity oil to open the farthest north production on the continent. This Eagle Plain discovery is one of the most important in the industry's history in Canada.

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Here's a tally of Kentucky news

A SURVEY of activity in Central Kentucky shows that 95% of the oil produced in this sector is still coming out of Greensburg pool in Green County. The pool itself is producing about 25,500 bbl. of oil daily with the field still moving north into Taylor County.

Edmonton pool in Metcalfe County is running about 800 bbl. of oil daily. The south edge of the old LeGrande pool in Metcalfe County is making about 400 bbl. per day. This decline is due to the Ratliff Mitchell flowing well which produced about 9,000 bbl. of oil before decreasing to 80 bbl. daily.

Flint Hill in Hardin County is making about 180 bbl. per day. The Joe Riddle Lease in Cumberland County dropped from 60 bbl. per day to 30 bbl. per day.

Other activity . . . About 3 miles southeast of McKinney in Lincoln County, drilling has increased during the past month.

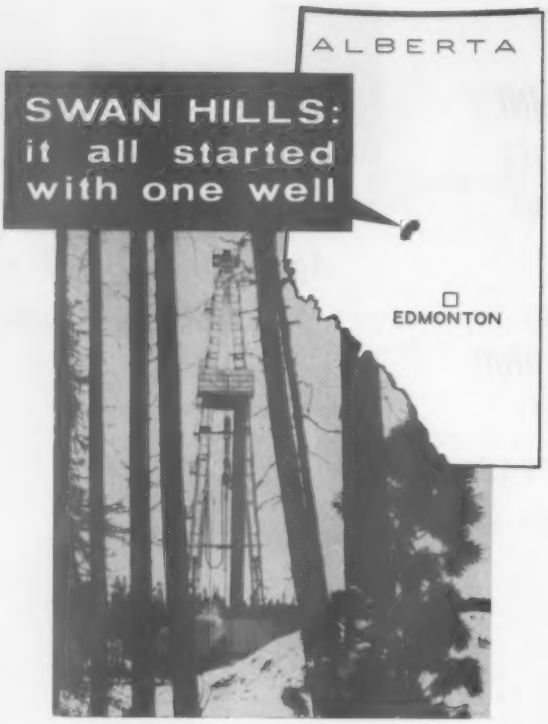
Most of the wells in this area are 80-300 ft. in depth, depending on surface elevation. It is reported that the shallow pay is in the Corniferous. In 1919 Lincoln County produced 4,973 bbl. of crude oil which is its biggest year by far. A. G. Wadsworth has reportedly purchased 19 leases totaling about 2,000 acres. He is in the process of replacing antiquated water-well type pumps with new pumping equipment and installing new tank batteries. The oil from Lincoln County is black and about 32° gravity. There are at least 8-10 rigs running in this general area.

Reliance Oil & Gas Co. of Denver has bought in on acreage in Cumberland County. Location is in the Salt Lick Bottom near Wolf Creek Dam. The company plans to rework some 50 old wells. These wells are now making about 1,200-1,500 bbl. per month, according to reports. There are four rigs working in the area.

Scipio output report

Latest available crude production figures credit the three-pool Trenton-Black River play in southern Michigan with 186,356 bbl. for the month of August out of total state production of 900,000 bbl.

Scipio, in Hillsdale County, with 43 wells, was good for 138,866 bbl. in the state proration report. The entire area is under 150-bbl. per well per day, but not more than 200 M.c.f. of gas.



Canadian oil operations leave . . .

No room for bears

SWAN HILLS early in 1957: bush and bears. Swan Hills by the end of this year: about 80 oil wells and a new town. And it all began with the drilling of one successful wildcat oil well.

Home Oil Co., Ltd., discoverer of the field, declares that $100,000,000 has been "pumped" into the economy of Alberta since discovery of Virginia Hills in 1957. Home also estimates that $16,000,000 has been invested on wells in this area 120 miles northwest of Edmonton.

More than $56,000,000 has been paid to the Alberta Government for leases and reservations.

Before Home Oil's discovery, the Swan Hills corridor was a "filed-and-forgotten" exploration district. A few shallow tests had been made and some seismic work was done.

Following the Home Oil discoveries, the big companies became exceedingly active. British-American and Pan-American joined in the opening of a big southern extension of Swan Hills. British American found the Sarah Lake field 20 miles southwest of the original Swan Hills well. Imperial hit at Judy Creek, 8 miles south of Sarah Lake. Texaco was successful 9 miles north east of Swan Hills. Shell stepped out 6 miles south east of Virginia Hills, and found an extension.

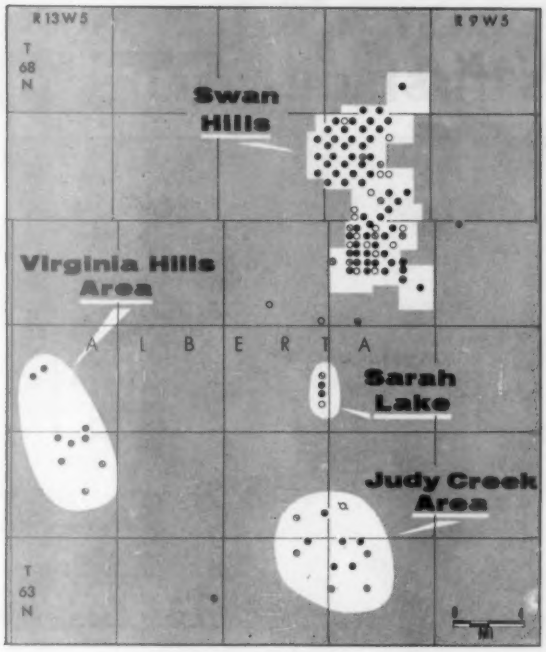
Since the discovery, the Home Oil team in Swan Hills—Home, Texaco, Kern Count, Alminex, and United—has alone completed 39 wells. It is anticipated this total will approach the 80-well mark by the end of this year in the entire area.

The Home Oil team has used 648,000 ft. of tubular goods, worth $1,217,000. It has spent $1,104,750 on its roads and grid system. Its seven batteries and flow lines have cost $923,000.

Home and Texaco Canada joined to build the Federated pipeline system from Swan Hills to Edmonton. With this year's extensions, the system has used up $8,500,000. It has consumed 9,100 tons of main-line pipe, and 2,800 tons of smaller-dimension pipe in its gathering lines. At 12 tons per load, 1,000 truck loads of pipe were used.

The provincial government is spending $2,000,000 on a road from Fort Assiniboine into Swan Hills and has established a townsite. During the height of the drilling season last year 400 persons were at work. The same number will be employed this year.

All this activity shows what one successful wildcat can mean.



Canada's busiest area...

ALBERTA'S busiest drilling area continues to be in the Swan Hills-Virginia Hills-Sarah Lake-Judy Creek sector, 130 miles northwest of Edmonton. There are 79 wells on the above map assured of commercial production. Of that number, 64 lie in Swan Hills, 2 at Sarah Lake, 6 in Judy Creek, 7 in the Virginia Hills area. There are 22 rigs active in the area with more due to start soon. Production is from the Devonian Beaverhill Lake from 8,000-8,500 ft. Pay thicknesses average about 125 ft. Map from Daily Oil Bulletin.

Asians study Alberta oil picture

A group of 23 geologists and mining engineers from Asia and the Far East is studying the Alberta oil and gas industry as part of a Canada-U.S. tour.

The trip is jointly sponsored by the United Nations bureau of technical assistance operations and the U.N. economic commission for Asia and the Far East.

In Calgary Dr. H. K. C. Kirk, member of the group and geologist of Geological Survey of Sarawek, said "We are very much interested in the oil industry in Canada because you have the same problems as we have in that you are distant from very large markets and find difficulties in marketing your oil."

The geology and mining experts are all senior members of their countries' governments. They come from British Borneo, Ceylon, Republic of China, Hong Kong, India, Indonesia, Iran, Japan, Republic of Korea, Federation of Malaya, the Philippines and Thailand.

During their Alberta tour they were guests of the Canadian Petroleum Assoication and the Alberta Society of Petroleum Geologists.

West Coast gas hunt steps up

THE SECOND extension test drilled by Occidental Petroleum Corp. on the big 34,000-acre Arbuckle gas field farmout deal from Western Gulf Oil Co. reportedly tapped 30 ft. of gas sand at around 5,550 ft. Drill-stem tests of two perforated intervals credited the zone with a flow potential of 6 M.M.c.f.d. through a ½-in. bottom choke. Occidental planned to take the well down another 1,000 ft. in a search for additional gas sands believed to be in the area.

The well, 1 Arbuckle Unit W, is located in SW NW 34-14n-2w. It offsets two Western Gulf wells to the west and another to the south.

Occidental's first project on the acreage was an unsuccessful wildcat located 4 miles northwest of the nearest field producer.

Occidental said it was stepping up its original one-well-at-a-time program to two wells at a time with the expectation it will have 10 wells drilled by Christmas. The field is being drilled on a 160-acre well spacing giving Occidental about 100 locations to drill in its farmout deal with Western Gulf.

North, west extensions enlarge Windgap area

A test of the "JV" sand in a Richfield Oil Corp. extension of the Windgap area-Wheeler Ridge field made gas at a rate in excess of 10 M.M.c.f.d. with 60°-gravity condensate in an undetermined quantity. The interval tested in the well, 34-30 Berry, was at 8,434-95 ft. It will be the most northerly well in the Windgap area when completed.

Also in the Windgap area, Richfield completed a well which ranks as the most westerly producer in the play. This well is 36-36 KCL L in SE NW 36-11n-20w. It was brought in flowing 240 bbl. daily of 21.3°-gravity crude through a 13/64-in. choke from perfs. at 5,473-5,648 ft.

East Gosford field moves northwest

Universal Consolidated Oil Co. moved on to a location on the extreme northwest edge of the East Gosford field, Kern County, and completed a good flowing well from perforations at 7,582-90 ft. Initial production was 176 bbl. daily of 35.2°-gravity crude through a 10/64-in. choke. Total depth of the test, 65-14 Statex, was 9,931 ft. It is just two locations south of an excellent well completed in this part of the field last July by Signal Oil & Gas Co. The Signal well came in for 298 bbl. daily.

Data released on S. California test

Humble Oil & Refining Co. released the results on its 1 Clarence Reed drilled in SW NW 35-8s-7w. This is the most southerly active test in the state, being virtually on the Orange-San Diego County border and only about 3 miles south of the town of San Juan Capistrano.

Humble perforated the 7,992-ft. wildcat at 5,862-90 ft. On the first test, it made some subcommercial quantities of oil. A pump was installed and production boosted to 12 bbl. daily gross, 9 bbl. net of 47°-gravity crude.

In South Texas . . .

Deep Edwards lands first oil

KARNES COUNTY'S recent 20-mile northeastward extension of South Texas' Deep Edwards production is making this the focal point of new deep drilling along the trend.

Since Brazos Oil & Gas Co. completed its long extension producer, six additional deep tests have been started. Four of these are within a 1-mile radius of the new discovery well. Another is 4 miles north. The sixth is farther removed, about 15 miles west in another prospective area 7 miles north of Fashing.

These raise to eight the number of deep Edwards tests now drilling in the county, the greatest number so far at any one time.

Brazos' new well, 1 Person, a rank wildcat, is rated as one of South Texas' most significant discoveries this year. Not only does it mark a long extension northeastward of the Deep Edwards trend of fields, but it is the first real oil production on the trend. Previous Deep Edwards production has been gas and condensate.

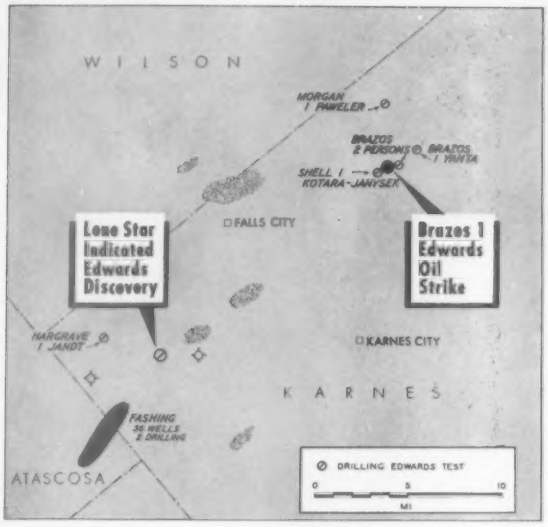
The well, completed late in August, flowed 650 bbl. of clean 38.9°-gravity oil daily while testing through 17/64-in. choke. Flow was with gas-oil ratio of 1,430 psi. under pressure of 1,527 to 1,575 psi.

For the present, the well is completed only in the upper of two good oil zones, one perforated at 10,886-900 ft. and the other at 11,026-44 ft. The lower zone tested 366 bbl. of oil daily, flowing through ½-in. and ¼-in. chokes, but is shut off pending a possible dual completion of the well later.

Location is 2 miles north of Helena, about 7 miles east of Falls City, and about that distance southeast of the Wilson county line.

Nearest and until now the most northeasterly Deep Edwards field on the trend is at Fashing, on the Atascosa-Karnes county line, where an active development program has been carried on the past 2 years. Nearly 35 wells have been completed, most of them dually, making this the largest and most important deep Edwards field to date. The Karnes County sector is an extension the Atascosa County production opened late in 1956.

New drilling around the Brazos discovery, since officially designated as Person field, includes another test by Brazos 2,640 ft. northeast on the same lease. Brazos, a division of Dow Chemical Co., also is drilling at 1 Gussie Yanta, about a mile northeast. Shell Oil Co. has two deep tests going, one west of the discovery well at 1 Kotawa-Janysek, and the other 5,350 ft. northeast at 1 Roberts (not shown on accompanying map). Four miles north of the discovery, Morgan Minerals Corp. is under way at its 1 Jerome Pawelek, a projected 12,500-ft. wildcat.



SURGE of new drilling enlivens northeastern extension of Deep Edwards trend through northern Karnes County.

A deep wildcat being drilled by Lone Star Producing Co. southwest of the shallow Hysaw field and about 4 miles northeast of Fashing field is stirring up additional enthusiasm in Deep Edwards prospects through Karnes County. This test, 1-A Woffard, now drilling below 11,800 ft., has been battling high gas pressures, and is giving indications of another discovery. First gas "kick" came while drilling at 10,650 ft. Not only did the mud become badly gas-cut but it showed considerable free oil. It was Lone Star that discovered the prolific Deep Edwards gas-condensate production at Fashing.

About 4 to 5 miles northwest of the Lone Star wildcat, Hargrave Oil Corp. is drilling on another Karnes County Deep Edwards test. This is its 1 Elsie Jandt, projected to 12,000 ft. This is northeast of another deep test Hargrave abandoned early in August after drilling to 11,476 ft. The latter was an old hole deepened from 5,509 ft. Other Deep Edwards drilling in Karnes County is in Fashing field.

In Ohio . . .

Holmes County pool jumps out

In Ohio, W. H. Patton reported successful completion of a ¾-mile stepout to a new pool discovery in northeastern Knox Township, Holmes County.

The 4 V. & V. Stonebrook, Section 24, logged the Clinton sand at 3,274-99 ft. and was shut in natural at 1,370 M.c.f.d. with rock pressure of 1,100 psi.

A ½-mile stepout by Darrell Blanton on 1 A. D. Ferree, Section 16, Swan Township, Vinton County, resulted in a 6,360 M.c.f.d. gasser with 832-psi. rock pressure after fracture. The Clinton sand was logged at 2,817-32 ft. and had 241 M.c.f.d. natural at this Holmes County well.

Another area reporting activity in attempting to establish production below the Clinton sand is Howard Township, Knox County.

Leland Shorts is now at 3,100 ft. in reopening 1 Frank Cochran, L 9 4 Qt., which was drilled in 1925 to a depth of 4,876 ft. A showing of oil in the Glenwood formation was indicated at that time. Clinton depth in this area is about 2,700 ft.

Kewanee Oil Co. has staked two more exploratory locations in Clinton County. 1 Van Pelt, L 1065 in Wayne Township and 1 Newton Igo, L 1458 in Washington Township.

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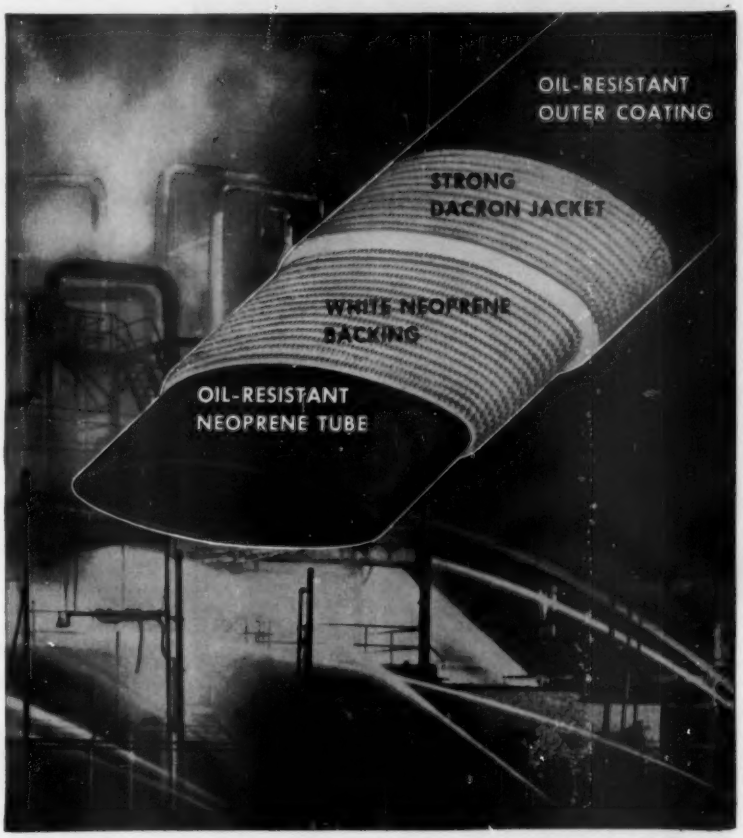

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Sixty-six wells show . . .

Pennsylvania's deep potential

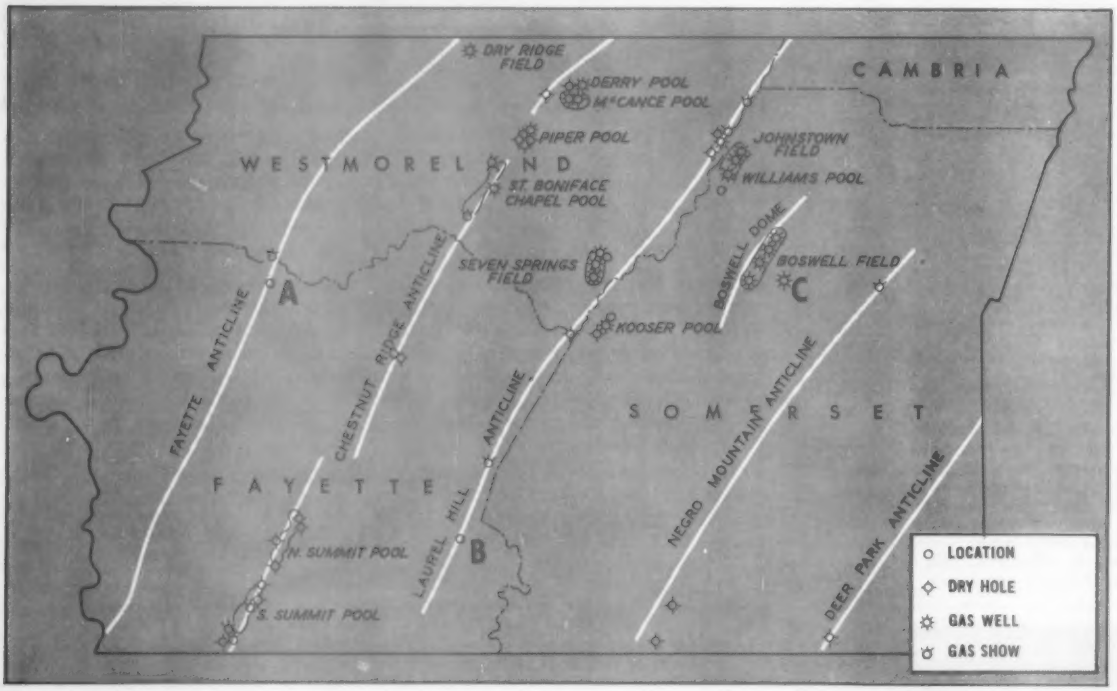
ROCKTON field is Pennsylvania's busiest gas-hunting theater. Fig. 1.

DEEP DRILLING continues strong in Pennsylvania. Since the first of the year more than 66 deep wells (Middle Devonian or older) have been completed. Gas pools were discovered in two of the eight wildcats drilled and the remaining six were dry holes. Two other wells, drilled as development wells, produced gas in separate fault blocks. Six of the other 56 development wells were dry holes and the rest produced gas.

Rockton leads . . . Rockton field in northern Clearfield County was the most active with 24 development gas wells and 3 dry holes.

The largest open flow recorded in the field during the first 7 months of the year was 70 M.M.c.f.d. from the Onondaga chert-Oriskany sandstone section from New York State Natural Gas Co. 11 Helen Gordon (1 on Fig. 1). Another well in this field had an open flow of 45 M.M.c.f.d.

Tract 65 . . . This pool in Boone Mountain field (Fig. 1) had 16 completions during the first half of the year, two of which were dry. This makes a total of 21 gas wells completed in this pool since its discovery



GAS PRODUCTION in this section of Pennsylvania is from Onondaga chert and Oriskany sand except for one Silurian well. Fig. 2.

in the fall of 1958. Production is from the Oriskany sandstone (Middle Devonian).

Regional activity . . . There are 18 wells now being drilled in the Boone Mountain-Rockton field area. The present trend of Tract 65 pool and Rockton field shows a possible junction of these two producing trends at their northern ends. Number two well on the map is being drilled by Shell Oil Co. This well is to be cored through the Onondaga limestone and Oriskany sandstone interval.

No Oriskany was found when well No. 3 (see Fig. 1) was drilled on the axis of the Sabinsville anticline. The Oriskany was found to be present when the discovery well of Tract 65 pool was drilled on the southeast flank of this anticline.

Reed-Deemer field just south of Rockton field had an additional gas completion the first half of the year.

In Indiana County, Nolo field had two development gas wells and Jacksonville field four development gas well completed.

Gas production from fields and pools (Fig. 2) is from the Onondaga chert and/or Oriskany sandstone except for a well in McCance pool producing from the Albion (lower Silurian).

Seven Springs field in Westmoreland County had two completions; another well is being drilled. These two completions make a total of three producers drilled since the discovery of the field in 1958.

Fayette County is the site of two wildcat operations. Drilling on the Fayette anticline (A on Fig. 2) is Snee & Eberly 1 G. G. Gault. The other (B on map) is Manufacturers Light & Heat Co. 1 Meuller-Herr. The target of both these wells is the Oriskany.

Drilling has found Somerset County to be as highly faulted as the rest of southwestern Pennsylvania. Three wells have been completed in Boswell field and a fourth well (C on map) on a separated fault block hit gas in the Onondaga chert-Oriskany sandstone. This field, discovered in 1958, has two wells which produced 5 M.M. c.f.d. of gas after fracture.

In Seven Springs field a new pool discovery was made with the completion of Peoples Natural Gas Co. 3 Pennsylvania Department of Forests & Waters Tract 75. This well on initial open flow made 10,933 M.c.f.d. of gas with a rock pressure of 3,350 psi. from the Onondaga chert. The well bottomed at 8,474 ft. in the chert. A well drilled to the south in 1958 was abandoned as a dry hole

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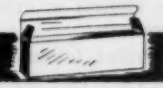

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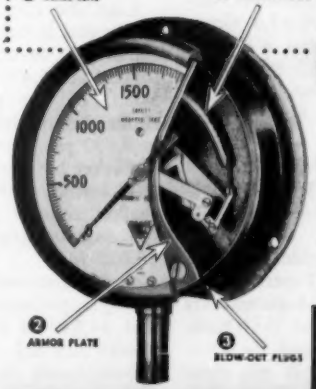

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after drilling in a highly faulted section. A confirmation well is being drilled to the north of the Kooser pool discovery well.

The three-well Williams pool is located north of the Kooser pool along the Laurel Hill incline. A well is being drilled here in an attempt to extend this pool to the southwest.

Wildcats were drilled in each of Butler, Elk, Mercer, and Warren counties. Each of these wells was dry in the Oriskany. Phillips Petroleum Co. discovered a new pool in Leidy field in Potter County. Two dry holes have been drilled in a highly faulted area trying to extend this pool. Another test is now being drilled in this same area.

At the end of July there were 18 wildcats and 31 development wells in operation. Wildcats in Fayette, Franklin, Greene counties as well as offshore in Lake Erie are being watched carefully.

In eastern Pennsylvania wildcats in four counties are trying to find gas production or gas-storage areas.

In Pennsylvania, Shell Oil Co.'s wildcat on Pennsylvania Tract 83, Elk County, was fractured. Open flow after fracture was 400 M.c.f.d. with rock pressure of 740 psi. in 30 minutes. The well is being cleaned out at total depth of 6,588 ft. Initial open flow went up to 1,500 M.c.f.d., then settled to 800 M.c.f.d.

In Butler County, the J. R. Davis wildcat, being drilled by T. W. Phillips Gas & Oil Co., is drilling at 2,006 ft. This is the third well to be drilled within a small area looking for gas.

In Greene County, John Galey's wildcat on the Herrington farm is only the second deep well to be drilled in this county. Location is on the Waynesburg dome of the Bellevernon anticline. The well is bottomed at 8,067 ft. after finding gas in the Onondaga chert-Oriskany sand section. Initial open flow was 140 M.c.f.d. Operators will fracture. Interest is high in this well as it is located 23 miles from nearest production. Also, this anticline has never had any deep drilling.

The offshore well in Lake Erie is fishing at a depth of 4,470 ft. This well is very near the porosity zone found in Pennsylvania's first offshore well last year.

The Meuller-Herr wildcat on the Laurel Hill anticline in Fayette County, being drilled by Manufacturers Light & Heat Co., found the Onondaga chert at 6,841 ft. and the Oriskany sand at 7,009 ft. A gas show was logged in the chert. The well is still in Oriskany at 7,048 ft., total depth. If fracturing should make this a good producer, exploration will be encouraged from Kooser pool south to the state line.

In Potter County, Phillips Petroleum Co.'s fourth well in the area is drilled at 4,500 ft. on Tract 81. This well is in a favorable location. It is hoped that it will be the second gasser in the new pool inside Leidy field.

St. Louis gas hit Inside Hugoton

IN SOUTHWEST Kansas, a Pan American Petroleum Corp. wildcat in the southwestern sector of Hugoton field has discovered gas in the Mississippian.

Pan American C1 Kinsler, located in 33-31s-40w, Morton County, flowed gas at the rate of 5,360 M.c.f.d. through a 2-in. opening.

Recovery was from the St. Louis lime (Mississippian) through perforations 5,464-66 ft. Operator plans to test other prospective zones in the Mississippian and the Pennsylvanian before final completion.

The 1C Kinsler was drilled to a total depth of 5,926 ft., plugged back to 5,513 ft. The well is 3 miles north of the nearest Mississippian production in Richfield pool.

Pan Am owns full interest in the well and in a 25,000-acre block in the area. The company also has extensive, shallower gas production in the area.

Ultradeep Louisiana offshore find confirmed

Discovery by Gulf Oil Corp. last March of ultradeep gas-condensate production more than 3 miles offshore from Redfish Point in Vermilion Bay, Louisiana Gulf Coast, is being confirmed by a Skelly Oil Co. test more than 1½ miles northeast.

Like the discovery well, the new Skelly test is being dually completed. Initial test in the deeper zone, perforated at 15,470-80 ft., flowed 4,250 M.c.f. of wet gas daily on ¼-in. choke. Bottom-hole pressure of 9,500 to 9,830 psi. were recorded.

Packer has been set above this zone and casing perforated opposite the shallow zone at 14,990-15,000 ft. for the dual completion. Total depth is 16,025 ft.

Gulf's discovery well on State Lease 3306 is perforated at 15,172-89 ft. and 14,640-54 ft. The deeper zone flowed 328 bbl. of 48.9°-gravity condensate with 4 M.M.c.f.d. of gas through 15/64-in. choke. Flow rate of the shallower zone was 336 bbl. of 55.8°-gravity condensate with 3 M.M. c.f.d. of gas through 14/64-in. choke.

Big Morrow well in eastern Beaver

Prolific Morrow Pennsylvanian gas-condensate production was tapped in eastern Beaver County at the east end of the Oklahoma Panhandle. The discovery well is Statex Petroleum Co.'s 1 Loyd E. Long, 8-5n-28eCM.

The operator potentialed the discovery for an open flow of 30 M.M. c.f.d. plus 20 bbl. condensate per million. Perforations are at 6,175-79 and 6,204-06 ft. This new strike is 2 miles from Mississippian production at Glenwood field and Glenwood-Gate Lake field.

More production for Dewey County

NORTHWESTERN Oklahoma's Dewey County has a new field. Texaco, Inc. completed its 1 Devereaux in C NW SW 9-17n-14w, near Oakwood, for 9,967 M.c.f.d. and 241 bbl. of condensate per day on ½-in. choke. Tubing pressure was 1,200 psi.

This discovery produces from Morrow Pennsylvanian through perforations at 9,490-9,500 ft. and 9,516-76 ft.

Other Dewey County news includes a good discovery prospect in Amerada Petroleum Corp.'s 1 Brewer in NE SW 23-18n-18w.

This well evidently has a thick pay zone in Morrow. A drill-stem test at 10,366-10,485 ft. got 5,200 M.c.f.d. and recovery was 65 ft. clean condensate, 720 ft. of fluid which had 360 ft. of condensate in it. First signs of commercial production at this wildcat came at a drill-stem test at 10,313-53 ft. when gas flowed at the rate of 19,500 M.c.f.d. plus 120 ft. of clean condensate recovered.

Panhandle County hits Mississippian

FIRST Mississippian production is reported in Texas' Lipscomb County in the northeast corner of the Panhandle.

The discovery well is Texas, Inc. 1 Anna Frass "G," Section 105, Block 10, HT&B Survey, 15 miles north of Lipscomb town. This strike opens the fourth pay in Frass field. The 1959 discovery has production in Tonkawa, Atoka, and lower Morrow, all Pennsylvanian.

The "G" well flowed 4,200 M.c.f.d. plus 3 bbl. condensate per hour from perforations at 8,848-59 ft. Top of the Mississippian was called at 8,847 ft.

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Two gas zones tapped in Louisiana

Two of the five potentially productive gas zones encountered in Arkansas Louisiana Gas Co.'s new discovery well in Ouachita Parish, North Louisiana, have been placed on production in the well's completion.

One is in the upper Hosston formation, perforated at 6,477-29 ft. It tested at the rate of 7,800 M.c.f.d. of gas, open flow. The other is in the lower Hosston, perforated at 8,494-8,502 ft. Flow from this is rated at 6,600 M.c.f.d.

The well, 1 S. Drew Kennedy, is about 6 miles southwest of Monroe in 2-16n-3e. It is about 12 miles east of the multipay Calhoun field, discovered by the same company 22 months ago. This field now has 10 wells with 19 productive gas and condensate zones.

Drilled to 10,300 ft. to explore the lower Cotton Valley section, the new Kennedy discovery well was assured by drill-stem tests of commercial gas production in the Causey sand at 5,678-87 ft., three zones in the upper Hosston formation between 6,130 and 6,650 ft., and in the presently productive 8,500-ft. lower Hosston formation.

The Cotton Valley section, topped at 9.328 ft., did not show for commercial production, so casing was run only to 9,360 ft. in the upper part and hole plugged back for completion in the Hosston.

The well is on a lease block of 3,500 acres owned 100% by Arkansas Louisiana Gas Co., although Pan American Petroleum Co., and Carter Oil Co. have lease interests in the area.

Nesson anticline oil moves south

An Amerada Petroleum Corp. wildcat in North Dakota is an apparent discovery—first oil in Dunn County, and the southernmost production on the Nesson anticline.

The 1 Signalness Unit recovered 6,140 ft. of free oil on drill-stem test of the Duperow (Devonian).

Location is 3 miles south of nearest production at Bears Den field.

Discovery wells

CALIFORNIA

Kern County: Richfield Oil Corp. 36-36 KCL L, SE NW 36-11n-20w, 878 BOPD, 21.7° gravity, 0.2% cut, 1½-in. choke, perfs. 5,473-5,630 ft., TD 8,165 ft. (New pool discovery on west edge of Windgap area-Wheeler Ridge field).

WESTERN CANADA

Alberta: Medallion-Great Plains 7-11 Plain Lake, LSD 7, 11-53-12w4. Viking gas discovery. TD 2,400 ft.

Saskatchewan: Tidewater-Pan American 8-11 Whitebear, LSD 8, 11-10-2w2. Mississippian oil discovery. TD 3,831 ft.

COLORADO

Prowers County: Skelly Oil Co. 1 Bailey, C NE NE 3-26s-45w. IPP 20 BOPD, 72 BWPD, Morrow discovery, new field. TD 5,545 ft. St. Louis.

NORTH LOUISIANA

Claiborne Parish: Magnolia Petroleum Co. 1 Thelma Worley, C SW NE 34-22n-8w, 1½ miles northeast of Blackburn. IP 1,263 M.c.f.d., 104 BCPD, 12/64-in., 63°, 2,573 psi., perf. 9,228-36 ft., Cotton Valley-Davis, and 130 M.c.f.d., 7 BCPD, 8/64-in., 52°, 610 psi., perf. 10,286-10,335 ft., Cotton Valley-Taylor zone. TD 10,507 ft. Newfield discovery.

Concordia Parish: E. C. Wentworth et al. 1 Sturgeon, 26-6n-7e, 1¾ miles northwest of Monterey. IP 90 BOPD, 9/64-in., 350 psi., perf. 5,643¼-45½ ft., Wilcox. TD 6,807 ft. Old dry hole worked over. New-field discovery.

Ouachita Parish: Arkansas Louisiana Gas Co. 1-B Chapman, 5-17n-1e. IP 6,750 M.c.f.d., 2,100 psi., perf. 4,742-49 ft., Rodessa-Hill sand. TD 9,794 ft. in Cotton Valley. New pay in Calhoun field.

Winn Parish: W. O. Weaver 1 Pray, 20-11n-1w, 1¾ miles northeast of Colgrade. IPP 50 BOPD, 20.6°, open hole 1,302-09 ft., Wilcox. TD 1,309 ft. New field.

MICHIGAN

Hillsdale County: McClure and Covey 1 Van Wert, SE SE SE 8-6s-2w, Adams Township, 5 miles southeast of Scipio field. IPF 30 BOPH, 12/64-in. choke. Elev. 1,153 ft. Trenton 3,466 ft., Black River dolomite 3,818 ft., pay 3,921-4,000 ft. TD 4,222 ft. New oil discovery.

MONTANA

Carbon County: Cardinal Petroleum Co. 1 Campbell, SE SE NW 4-27n-5w. IPP 15 BOPD, Madison discovery, new field. TD 2,496 ft.

NEBRASKA

Kimball County: Signet Operating and Exploration Co. 1 Palmer-State "A," C SE SW 36-13n-56w. IPP 104 BOPD, "J" sand discovery, new field. TD 6,680 ft. Skull Creek.

NORTHWEST NEW MEXICO

Rio Arriba County: J. Glenn Turner 34-36 Rosa Unit, SE NW NE 36-32n-6w. IPF 2,955 M.c.f.d., Mesaverde discovery, new field. TD 6,150 ft.

SOUTHWEST TEXAS

Bastrop County: Humble Oil & Refining Co. 1 E. W. Jones, Teresa Highsmith Sur., A-194, 1½ miles west of Paige. IP 170 BOPD (net), 1% water, 23.9°, perf. 6,968-7,012 ft. Buda lime. TD 9,816 ft. Discovery well Paige field.

Duval County: C. C. Winn 20-C Mew Estate, Section 287, J. Poitevent Sur., A-416, 18 miles northwest of San Diego. AOF 3,000 M.c.f.d., dry gas, shut-in TP 1,240 psi., perf. 3,132½-37½ ft., Jackson-Cole sand. TD 3,650 ft. New pay in Johns field.

Morgan Minerals Corp. and Weaver & Sharp 1 Parr-Moffett, Share 5-A, La Huerta Grant, A-227, 9 miles southeast of Benavides. AOF 17,500 M.c.f.d., GLR 30.86 M.c.f. per bbl., 54.6°, shut-in TP 4,647 psi., perf. 7,212-13 and 7,249-50 ft., Dolores sand. TD 7,520 ft. Discovery well Givens field.

Katz Oil Co. and George Coates 3-B W. R. Peters Estate, Section 40, GB&CNG Sur., 13 miles southwest of Freer. IPP 10 BOPD (net), 2% water, 19.7°, GOR 760 cu. ft. per bbl., perf. 1,772-74 ft., First Cole sand. TD 2,100 ft. New reservoir in North Peters area.

Gulf Coast Mineral, MFMT Corp., and Joseph E. Burkhart 1 C. M. Robinson, Section 408, Paul Henry Survey, A-1324, 8 miles northwest of San Diego. AOF 7,200 M.c.f.d., GLR 63.7 M.c.f. per bbl., 60.7°, shut-in TP 2,136 psi., perf. 5,585-91 ft. and 5,598-5,607½ ft., basal Yegua. TD 5,710 ft. New reservoir and extension Robinson field.

Maverick County: Continental Oil Co. 40-3 N. J. Chittim, Section 40, Block 6, I&GN Sur., A-646, 19 miles east of Eagle Pass. IP 54 BOPD, 15/64-in., 25.5°, GOR 201 cu. ft. per bbl., 70 psi., perf. 1,880-86 ft., Sacatosa lime. TD 1,945 ft. New pay in Sacatosa field.

McMullen County: Humble Oil & Refining Co. 1-D Louis M. Gubbels, McKinney & Williams Sur., 11 miles northeast of Tilden. IPP 35 BOPD (net), 3% water, 38.2°, GOR 341 cu. ft. per bbl., perf. 6,132-38 ft., Wilcox. TD 6,501 ft. New pay in San Miguel field.

Starr County: Sun Oil Co. 16 J. F. Hall-State, Section 224, C. B. Simpson Sur., 32 miles northeast of Rio Grande City. IP 67 BOPD (net), 21.1% water, 9/64-in., 43.5°, GOR 4,231 cu. ft. per bbl., 1,150 psi., perf. 6,302-10 ft. TD 7,500 ft. New pay in North Rincon field.

Farenthold & Pitcairn 1 Brock, Lot 15, Goodwin Yantis Subd., Porcion 86, 15 miles northeast of Rio Grande City. IP 58 BOPD, ¼-in., 26°, GOR 300 cu. ft. per bbl, TP 150 psi., perf. 2,520-22 ft., Frio. TD 2,910 ft. Discovery well Pearl field.

Bass & Vessels 1 E. Pena Contreras, Tract 14, Olivares Addition, Share F, Santa Teresa Grant, 4 miles northwest of Delmita. IP 94 BOPD, p-33 choke, 49.1°, GOR 718 cu. ft. per bbl., 660 psi., perf. 5,453-56 ft. Frio. TD 5,970 ft. New pay in North Sun field.

Val Verde County: Ashmore & Ewell et al. 3 Massie West, Mason County School Land Sur., 5 miles northwest of Juno. IPP 14 BOPD, 17.8°, perf. 360-74 ft., Paluxy. TD 407 ft. New-field discovery.

Webb County: General Crude Oil Co. 2-A Adami, Section 15, BS&F Sur., A-926, 17 miles northwest of Freer. IP 56 M.c.f.d., 7/64-in., perf. 7,496-7,526 ft., Wilcox. TD 7,724 ft. Extends Adami-Wilcox field.

Weaver & Sharp 1-C Dan Adami Estate, Section 4, 20 miles northwest of Freer. IPP 36 BOPD, 21°, perf. 1,077-82 ft., Mirando sand. TD 1,209 ft. New-field discovery.

Union Producing Co. 12 J. D. Jennings, Section 207, Jose Manuel Pedro Sur., A-73, Cerrito Blanco Grant, 7 miles northeast of Bustamente. IP AOF 1,775 M.c.f.d., GLR 84 M.c.f. per bbl., 50°, shut-in TP 1,689 psi., perf. 4,418-22 ft., Queen City. TD 5,650 ft. New pay in Jennings field.

WYOMING

Sweetwater County: Gulf Oil Corp. 2 Federal-Unit, SW SE 18-12n-94w. IPF CAOF 9,200 M.c.f.d., Wasatch discovery, new field. TD 4,897 ft. Fort Union.

Caulkins Oil Co. 4-8 A Federal, SW SW 8-15n-103w. IPP 20-25 BOPD, Dakota discovery, new field. TD 5,055 ft.

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(Above) **A NEW installation in the Baroid supply and service network is the waterpoint location just off the Intracoastal Canal at Bayou Sale. Here Baroid's former off-shore delivery vessel has been converted into a huge drilling mud warehouse.**

(Above) **CARRYING a 100-ton payload up to speeds of 10 knots per hour, the Baroid Express delivers bulk BAROID® to offshore rigs f-a-s-t.**

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(Below) **HOUMA is headquarters for Baroid liquid mud barges which have their own mud mixing equipment. To the left of the bagged products are the newly installed liquid mud storage and make-up tanks.**

(Left) **EMPIRE is the maintenance base for the barge-mounted pneumatic bulk plants and a terminal for Baroid barges and tugs carrying palletized bag products to the drilling industry in Louisiana and offshore.**

(Below) **LEEVILLE is home base for the Baroid Express. Also at dockside, a barge-mounted pneumatic bulk plant with a Fuller system which can deliver over 75 tons of bulk BAROID per hour.**

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Bouwe Dkystra Looks Ahead

• Shell vice president is a dynamic, affable man whose fabled career stretches from Holland to New Orleans.

BOUWE DKYSTRA is a transplanted Dutchman who took "pot luck" when he decided to make his mark with Shell in the United States.

It was in January, 1931, after 3 years of slogging through the oil fields of the Dutch East Indies that "Bo" Dkystra cut loose his ties with his native Netherlands, and with the Shell group as well, to become an immigrant and start all over again at a place called Marshall, Okla., south of Enid.

It wasn't so surprising that he landed a job with Shell in the U. S., but, as he describes it today, "I wasn't the Student Prince type."

Today, Vice President Dkystra, who runs the Shell exploration and production organization at New Orleans, is pleased with his Americanization. He still has something left of his Dutch accent, but he's as native as his nickname (only his wife calls him BOH-ah).

Just a few days ago his fellow oilmen elected him for a second year as the president of the Louisiana-Arkansas Division of the Mid-Continent Oil & Gas Association, and he holds the deepest admiration and respect of both the industry and his home city of New Orleans.

His reputation as an effective oil finder and business administrator is perhaps without parallel in Louisiana. One oil man said the other day: "Bo Dkystra has a better grasp of the oil business than any man I ever met."

From the start . . . Dkystra was born February 26, 1901, on a farm in the Friesland area of Holland.

But he turned from farm life to engineering and received his degree in mining in 1926 at the University of Delft near the Hague.

The Royal Dutch-Shell organization, one of the real petroleum giants of the world, hired him and sent him to Romania as a geologic trainee.

Then Shell shipped him off to Sumatra. For 3 years he moved about the Dutch East Indies and decided he'd had enough. He had known many Americans in the oil fields of Romania and Sumatra and decided he wanted an American future.

He landed as an immigrant in Marshall, Okla., starting at the bottom and helping to build a gas-lift compressor plant for Shell.

Soon he was moving about the oil patch, first in East Texas as a field engineer, then in West Texas, then briefly in Houston, then at Iowa, La., and then back to Houston (in 1934) as assistant to the chief exploration engineer.

Bouwe Dkystra
. . . "better communication is needed."

He went to Corpus Christi as field superintendent for a year, then to Tulsa as area chief exploitation engineer (1936-39), and then out to Los Angeles for 2 years in the same job.

His U. S. sojourn was interrupted for 6 years when Shell sent him to Colombia as technical manager and later vice president of the Shell operating company there. He helped discover Colombia's Casabe and Dificil fields.

Back in the U. S. he became area manager at Midland, where he directed exploration and production for West Texas and New Mexico. Then—and finally—he went to New Orleans in 1949 to end his moving days.

"My wife tells me we moved 39 times," he says.

Offshore pioneer . . . In New Orleans, Dkystra really came into his own. Arriving at a time when offshore drilling was in its infancy, he built Shell into a top spot among the operators in the Gulf of Mexico.

For 2 years he was the area manager and in 1951 was promoted to a vice presidency in charge of exploration and production.

Dkystra has become probably the best offshore expert in the industry—both as operator and administrator. He also has become a vocal critic of the low allowables granted expensive wells in the Gulf and of the excessive regulation of the industry.

In his job as president of the Louisiana-Arkansas Mid-Continent, Dkystra is attempting to make the industry's voice better heard among the general public.

"We need better communications both within and outside the industry," he says. "We are doing a reasonably good job—but not anywhere are we doing what we can, and ought, to do."

As an example of what he was talking about, Dkystra promoted the recent Mid-Continent meeting so heavily among the nonoil people at New Orleans that the luncheon and dinner sessions overflowed.

What's ahead . . . Under Shell's retirement-at-60 policy, Bo Dkystra has a year and a half to go.

For a man whose capacity for work is equal to one far younger, and whose sharp wit knows no master, quitting work is almost unthinkable.

And Dkystra isn't quitting.

In fact, he's looking forward to "retirement" as a challenge—a time when "this company protection" no longer will be a cloak about him.

"I honestly like the oil business," he says. "The people in it are big people."

Specifically, he is casting his eyes abroad—a somewhat strange reversal of the day when he cast his eyes toward the U. S.

"I see the American oil industry is going abroad," he says. "I might use some of my background to advantage."

But he'll not move the fortieth time. Home will always be in New Orleans.

"I've become a Cajun," says Louisiana Citizen Dkystra with a broad grin.

"One thing I liked about becoming an American was the freedom of opportunity—and I'm not talking sentimental nonsense," he adds with the seriousness of a man who made an important decision long ago and is glad he did.

●

T. R. Coffield, Gulf Oil Corp. superintendent in Crane, Tex., has been transferred to Laurel, Miss., as area manager.

▶▶▶ Personals

R. O. Rhoades, a director and executive vice president of Gulf Oil Corp., has been elected chairman. He succeeds **David Proctor,** who has resigned after 40 years with Gulf and its affiliates. Rhoades has been with Gulf since 1926 and has been chief

RHOADES

PROCTOR

staff geologist, vice president in charge of exploration and production, and senior vice president. Rhoades has served Gulf and its affiliates in the Middle East, Latin America, and Far East. He was elected a director in 1957 and executive vice president last year. Proctor joined Gulf in 1919 in Fort Worth. He was named vice president, a director, and general counsel in 1945. He became executive vice president in 1954 and chairman of the board last year.

John W. Coolidge, petroleum engineer with Trunkline Gas Co., has been promoted to assistant chief petroleum engineer. Coolidge has been with the company since 1955.

Dr. J. T. Richardson has been promoted to senior research physicist in Humble Oil & Refining Co.'s Baytown, Tex., research and development division.

H. C. Harris, Jr., manager of the Dallas-eastern region of Atlantic Refining Co., will be manager of the combined operations created by consolidation of the Tulsa and Dallas offices. Atlantic will close its Tulsa office January 1.

Harry Jeffries, a director and executive vice president of Sinclair Oil Corp., has been elected chairman of the finance committee, a new position. **Iver J. Bergholt,** assistant treasurer and vice president, has been elected treasurer. He succeeds **W. F. Dau,** who has retired. Other members of the finance committee, besides Jeffries, include Bergholt, **Robert L. Clarkson** and **William Gage Brady, Jr.,** both Sinclair directors, and **O. P. Thomas** and **C. J. Allen,** vice presidents.

Avery E. McKinney, formerly with Phillips Petroleum Co. in Sweeny, Tex., has joined Monsanto Chemical Co.'s Lion Oil division in the Texas City research department.

James H. Cobbs, formerly division reservoir engineer for Tidewater Oil Co. in Tulsa, has become consulting petroleum engineer in Tulsa. He will specialize in appraisals, valuations, and field supervision.

Robert L. Hoss, production superintendent for Vaughey & Vaughey in Denver, has resigned to open offices as consulting petroleum engineer, Denver. He will specialize in production problems. Hoss will continue as a consultant to Vaughey & Vaughey.

Carroll J. Brown, Riverside, Conn., has been named executive development advisor of Standard-Vacuum Oil Co. He succeeds **Lawrence C. Hamlin,** who recently was appointed regional vice-president in charge of the company's Far East operations.

Dr. Raymond C. Moore of the State Geological Survey of Kansas and University of Kansas, will become an honorary member of Kansas Geological Society at ceremonies during the Mid-Continent regional meeting of American Association of Petroleum Geologists in Wichita October 29. Moore is already an honorary member of AAPG and was awarded the group's Sidney Powers Medal last year.

Dr. C. Vernon Foster is now associated with Dr. H. C. Schutt, Consulting Engineer, Boston. Dr. Foster has previously served as a group leader in Continental Oil Co.'s research and development department, and as a process engineer with Ethyl Corp. He also was associated with the research department of C. F. Braun & Co.

F. J. Hopkins has been named coordinator of contracts in Natural Gas Pipeline Co.'s Amarillo, Tex., production office. **T. R. Stalnaker** has been named superintendent of the Malvern, Ark., compressor station of Texas Illinois Natural Gas Pipeline Co., affiliate of Natural Gas Pipeline. Stalnaker replaces **A. E. Moody,** who has retired. **R. W. Horst,** superintendent of Natural Gas Pipeline's Pampa, Tex., booster station, will succeed Stalnaker as superintendent of Texas Illinois' Jackson, Mo., compressor station. Also, **R. W. Lindgren** will succeed Hopkins as assistant to the president of the affiliate firms. **J. E. Stoffregen,** special engineer in Chicago, will succeed Horst in Pampa.

R. M. Pemberton, assistant superintendent in Olney, Ill., for Pure Transportation Co., has been transferred to Gueydan, La., as superintendent.

Robert Qualls, formerly projects engineer with British-American Oil Producing Co., has joined Sage Oil Co., Denver, as manager of exploration and production.

H. P. Aston, assistant regional superintendent in Dallas for Sun Oil Co., has been appointed regional operating superintendent in the southwest division. Aston succeeds **R. L. Inglish,** who has retired after 40 years with Sun. Inglish had held the Dallas post since 1943.

Richard J. Plank, vice president in charge of operations for Peoples Natural Gas Co., has been elected executive vice president of New York State Natural Gas Corp., an affiliate. Plank has been designated to become president of New York State Natural when **Fenton H. Finn** retires February 1. Finn had been president of the company since 1953. He served as production engineer, chief geologist, and vice president before that time. He has been system geologist of Consolidated Natural Gas Co., the parent company, since 1942. Plank has been with Peoples gas since 1936 as assistant superintendent of distribution, executive assistant to the president, superintendent of distribution, general superintendent, vice president, and vice president of operations.

PLANK

Donald H. Bancroft, assistant manager of Creole Petroleum Corp.'s Tia Juana district in Venezuela, has been promoted to manager. He succeeds **Jesse L. Ford,** who has retired. **James H. Dean,** formerly on special assignment in the western division, will succeed Bancroft.

Robert Winters, president of Rio Tinto Mining Co., of Canada, Ltd., has been named chairman and president of Devon Palmer Oils, Ltd. **Morris N. Palmer** has resigned as president of Devon Palmer and will devote full time to Canamerican Drilling, Ltd., a subsidiary. **Roger Jeanty** and **George Baker,** both of Rio Tinto, have been named vice president and secretary of Devon Palmer. **John Aird** will continue as a vice president.

▶▶▶ Personals

Fred Wallace, production foreman for Ambassador Oil Corp., has been transferred to Oklahoma City from Cushing, Okla.

Harry B. Wood, vice president of United Natural Gas Co., has been elected executive vice president. He has been with the company since 1924.

Robert J. Smouse has been promoted to assistant chemical engineer, technical division, at Humble Oil & Refining Co.'s Baytown, Tex., refinery.

Henry J. Muller, retired central region manager of Socony Mobil Oil Co., Inc., has organized Michi-Kan Oil, Ltd., to engage in oil and gas production. Muller is general and managing partner of Michi-Kan.

Donald B. Black, formerly on special assignment in chemicals sales for Dow Chemical Co., has been named assistant purchasing agent for raw materials in Dow's Midland, Mich., division.

Frank S. English, Jr., staff assistant to the manager of Ohio Oil Co.'s refined products distribution department, has been appointed supervisor of a new products supply coordination department. English has been with Ohio since 1936.

Theodore E. Waibel, Jr., intermediate petroleum engineer in Tulsa for Sinclair Oil & Gas Co., has been transferred to Lindsay, Okla. **Leo S. Kirkpatrick,** roustabout in Kiefer, Okla., has been promoted to assistant foreman and transferred to Woodward, Okla.

A. W. Mallow, formerly superintendent of Phillips Petroleum Co.'s Big Spring district in West Texas, has been appointed superintendent of the Odessa, Tex., district. He succeeds **R. A. McKnight,** who has retired. **G. C. Watson,** Houston, will replace Mallow in Big Spring. He was formerly senior engineer of the Gulf Coast production division.

Robert Harkins, Edward J. Ingram, and **Francis J. McElhatton** have been elected vice presidents of Panhandle Eastern Pipe Line Co. Harkins will be vice president in charge of production and supply. Ingram will be vice president in charge of rates and economics, and McElhatton vice president in charge of gas transmission and gathering. They will headquarter in Kansas City.

Henry M. Hanbury, manager of the foreign sales division of Texaco Inc., has been appointed general manager of the foreign operations department, Western Hemisphere and West Africa. He succeeds **Landon B. Derby,** who was recently elected vice president in charge of the department. Also, **S. A. Berthiaume,** vice president and general manager of Texaco Exploration Co. Calgary, has been named manager of the exploration division, domestic producing department, a new position. Berthiaume will headquarter in Houston. In other appointments in the domestic producing department, **O. F. Sebesta,** assistant

HANBURY

BERTHIAUME

division manager in Midland, Tex., has been promoted to assistant general manager of the department. He will headquarter in Houston. Sebesta succeeds **J. W. Rawley,** who has been named Tulsa division manager. He succeeds **H. O. Woodruff. L. W. Calahan,** New Orleans assistant division manager, has been named Dallas division manager. He succeeds **L. F. Shiplet,** who has been transferred to Houston as assistant to the general manager. **G. H. Clark,** formerly assistant division manager in Houston, has also been named assistant to the general manager there.

Dr. George Grovier has been named acting chairman of the Alberta Oil and Gas Conservation Board, filling the vacancy created by the resignation of **D. P. Goodall.** Grovier will remain acting chairman until the return of **Ian McKinnon,** who has accepted a 2-year assignment as chairman of the Federal National Energy Board.

Dr. Melvin DeGroote, vice president for research, development, and patents for Tretolite Co. division of Petrolite Corp., will receive the 1959 Midwest award of American Chemical Society's St. Louis section. The award will be presented November 7 during the group's technical symposium. A graduate of Ohio State University, DeGroote has been with Petrolite since 1924. He is holder of 909 patents, many of them on crude-oil demulsification.

Robert Carlson, geologist in Del Rio, Tex., for Shell Oil Co., has been transferred to Casper, Wyo.

W. H. Graves, formerly research engineer with Shell Oil Co. at the Houston refinery, has joined Beckman Instruments Corp. in Fullerton, Calif., as project engineer.

Augustus B. Small of Esso Research & Engineering Co.'s chemicals research division, has been named a research associate. Small has been with Esso Research since 1939.

Lemuel D. (Lem) Bechtel, assistant division superintendent of production in Casper, Wyo., for Ohio Oil Co., has retired. He had been with Ohio 38 years.

J. A. Sheridan, division manager for Shell Oil Co., Milwaukee, has succeeded **I. H. Dawes,** vice president of Clark Oil Co., Milwaukee, as chairman of the Wisconsin Petroleum Council.

Dr. Morton J. Klein has been named supervisor of propellant chemistry at Armour Research Foundation of Illinois Institute of Technology. He has been with the Foundation since 1953.

Bruce O. Bayaert, R. J. McCarter, John Walden, and **Everett E. Spitler** have joined California Research Corp.'s Richmond, Calif., laboratory as research engineers. **Allan J. Humphrey** will be research mathematician at Richmond. **George D. Boozer** has joined the La Habra, Calif., laboratory as research engineer.

R. E. McMillen has opened offices in Tulsa as geophysical and geological consultant. Until recently he was managing partner in the firm of McMillen, Thralls, Green, Perry, & House. He has also served as geophysical exploration consultant for the Bureau de Recherches de Petrole, both in France and Africa.

Robert C. Bradley, formerly sales manager of Texas Natural Gasoline Corp., and three other men have organized a new firm, Royal Gas Products Co., Tulsa, for production and marketing of LPG and natural gasoline. Bradley will be president of the new organization. Other officers include **A. B. David,** vice president for supply and transportation; **R. J. Dent,** vice president and secretary; and **P. V. Smithen,** treasurer.

Personals

John C. Capshaw, formerly exploitation engineer for Shell Oil Co., has joined John W. Mecom, Houston independent.

Scott C. Denison, Jr., production engineer with Shell Oil Co., has been transferred to Houston from Kilgore, Tex.

Robert Habart, geologist with the California Co., has been transferred from New Orleans, La., to Casper, Wyo.

Zed D. Grissom, division exploitation geologist in Tulsa for Sinclair Oil & Gas Co., has been named manager of the Anchorage, Alaska, district office. He succeeds **Richard L. Porter. Clarence H. Unruh,** intermediate geologist in Ardmore, Okla., also has been transferred to Anchorage.

R. L. Perrine, formerly in the petroleum production research department at California Research Corp.'s La Habra, Calif., laboratory, has been named associate professor of engineering in the department of engineering, University of California, Los Angeles. Perrine had been with Cal Research in La Habra for 6 years.

Leonard W. Littlefield, formerly junior petroleum engineer with Sinclair Oil & Gas Co. in Nowata, Okla., has joined Continental Oil Co. in Big Spring, Tex., as production engineer.

Everett M. Barber, senior research technologist for Texaco, Inc., has been elected a director of American Society of Mechanical Engineers. **Henry W. Evans,** assistant superintendent of engineering for Sinclair Oil & Gas Co., has been named director of the petroleum activities committee of ASME's Mid-Continent section.

Ira B. Loyd, field representative of the crude-oil purchases and sales division of Texaco, Inc., in Casper, Wyo., has been transferred to Tulsa as head of the crude-oil purchases and sales division there. He succeeds **E. W. Russell,** who retired October 1 after 42 years with Texaco and its affiliates.

Jed B. Maebius has been named manager of the exploration department in Tidewater Oil Co.'s southern division, Houston. He succeeds **T. G. Kelliher,** who was recently named exploration manager for domestic operations in the Los Angeles headquarters. Maebius was central division exploration manager for Tidewater before that division was combined with the southern division several months ago.

Henry A. Witcher, division superintendent of gas and gas products in Houston for Sinclair Oil & Gas Co., has been promoted to superintendent of operations in the general office of the gas and gas products department, Tulsa. Also, **William J. Rogers** assist-

WITCHER

ROGERS

ant division production superintendent in Fort Worth, has been promoted to assistant chief petroleum engineer in Tulsa. Rogers succeeds **F. F. Wright,** who was named executive assistant in the exploration department earlier this year.

R. Y. Pogontcheff, division engineer in Edmonton for Shell Oil Co. of Canada, Ltd., has been transferred to Bakersfield, Calif., as mechanical engineer with Shell Oil Co.

William Leonard Swearngin, formerly with Phillips Petroleum Co., has been appointed manager of supply for Texas Natural Gasoline Corp. He will headquarter in Tulsa.

Deaths

Three Houston oil men were among the 34 persons killed last week in the crash of a Braniff Airways turbojet airliner near Buffalo, Tex. They were **J. B. Petkas,** drilling contractor, **Charles B. Quick,** salesman for Mid-Continent Supply Co., and **A. E. Ferrell,** geologist and Houston representative for Fairchild Aerial Surveys. Petkas, 44, operated under his own name and also owned San Jacinto Drilling Co. Quick, 35, had worked for Mid-Continent about 10 years. He and Petkas were traveling together enroute from Houston to Tulsa to look at some equipment. Ferrell, 46, was a geology graduate of Texas Western College, El Paso. He had worked for Fairchild for about 2 years.

Herbert O. Wolfe, Wewoka, Okla., oil man, died September 26 in a Tulsa hospital. He was 69.

John Hartwell Hillman, Jr., 79, chairman of Texas Gas Transmission Corp., died September 26 in Pittsburgh. Hillman organized Texas Gas in the 1940's and had been chairman since that time. He had other wide business interests in steel, chemical manufacturing, real estate, and banking.

Glenn O. Hopkins, 50, Refinery Engineering Co. industrial relations and personnel manager, died September 28 in a Tulsa hospital. He had been with Treco since 1952.

W. R. (Dick) Guiberson, 84, partner in Guiberson Tool Co. before its sale to Dresser Industries, Inc., several years ago, died September 27 in a Pasadena, Calif., hospital.

John H. Pegoda, 55, manager of the supply and distribution of accessories for Gulf Oil Corp., died September 22 in a Houston hospital after a long illness.

T. D. Turnbull, 64, assistant manager of Jones & Laughlin Steel Co., Pittsburgh, died September 24, after a heart attack.

Marvin A. Park, 63, Casper, Wyo., district manager for Jones & Laughlin Supply Division, died recently in a Casper hospital. A native of Texas, Park had been with the firm since 1933.

Wood R. Alexander, 73, retired Houston independent, died September 27 in a Houston hospital. In the oil business since 1913, he was one of the original wildcatters and had drilled more than 100 oil wells in Texas and Oklahoma. Alexander retired in 1945.

W. Ewart Bannerman, 58, president and general manager of Page Hersey Tubes, Ltd., and president of Welland Tubes, Ltd., died recently in Toronto. Bannerman had been with Page Hersey since 1918.

Dan D. Smith, formerly manager of the pipeline division of the old Kanotex Refinery Co., died September 28 in Arkansas City, Kans. Smith was with Kanotex before its sale to Anderson-Prichard Oil Corp.

SALT WATER CORROSION

How Lukens *Application Research* can help you find the right steel plate for the job

Among other materials, our Application Engineering staff has studied the outstanding nickel alloy, Monel, in a variety of salt water applications. Monel is surprisingly economical when used in clad plate form—a Lukens specialty produced by bonding a layer of Monel to a tough, low-cost carbon steel backing plate.

The massive legs of off-shore radar platforms, for example, are protected by Lukens Monel-clad steel plate. Our engineers recommended this shielding for the critical splash areas extending above and below the water line. It has proved a most successful application.

Salt water swimming pools on ocean liners, traditionally of tile, often require extensive repair between voyages. We helped solve this problem for a well-known steamship line—again with Monel-clad steel plate. Beautiful to look at, these sea-going pools need only routine cleaning and maintenance. Many are now in service—others are being built, including one on the nuclear powered *Savannah*.

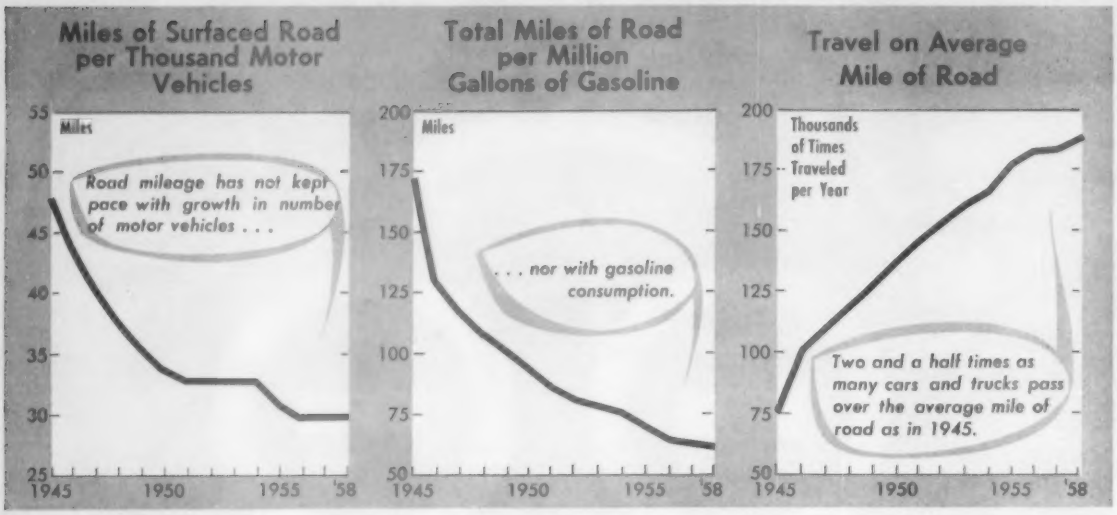
If your assignment is salt water corrosion, let it be our assignment, too. Lukens Application Engineers have documented cases covering a wide range of materials selection problems—to help you choose the right steel plate.

Contact Manager, Application Engineering, P109 Services Building, Lukens Steel Company, Coatesville, Pa.

Helping Industry Choose Steels That Fit The Job

LUKENS

ASK FOR THE BULLETIN ON LUKENS CLAD STEELS



A look at these figures indicate . . .

Highway construction shortchanged

BY JOHN C. CASPER

HIGHWAYS are crowded with cars and trucks. Motor-vehicle registrations are gaining, but special taxes on the motorist are climbing even faster. Another cent has been added to the federal tax on gasoline to prevent a complete breakdown in the national highway program.

Special taxes on the motorist have more than tripled since the end of World War II but there is still a shortage of driving room on our highways.

These special taxes amounted to more than 9 billion dollars last year compared with a little over 2.5 billion for 1946. Collections include state receipts for registration, state and federal gasoline taxes, special city and county taxes, tolls, and other federal excise taxes.

Not all of the 9 billion dollars collected from the motorist last year was used for more and better highways. About 2 billion dollars was siphoned off for other government expense not connected with highway construction.

The charts on this page show that all of the 9 billion dollars is needed for highway improvement if the motorist is to have a place to drive.

Car registrations have increased faster than highway mileage. In the first year after World War II, motorists registered almost 34.4 million cars, buses, and trucks. The total for 1958 was 68.3 million, for a gain of 98.5%.

In the same period, total miles of rural surfaced roads increased from 1.5 million miles to 2.1 million, a gain of 40%. This trend resulted in a steady decline in the number of miles of surfaced road per vehicle. Stated in reverse, there were 22.9 motor vehicles per mile of surfaced road in 1946, and the density had moved up to 33.2 cars per mile in 1958.

The second chart shows that highway mileage has not kept pace with gasoline consumption. Back in 1946, use of gasoline on the highways amounted to 26.6 billion gallons. By 1958, the total had climbed to 53.4 billion gallons or a little more than double the total consumed in 1946.

Total rural and municipal road mileage, however, showed almost no gain for the period. Total road mileage in 1946 amounted to 3.3 million miles and had increased only to 3.5 million miles by 1958.

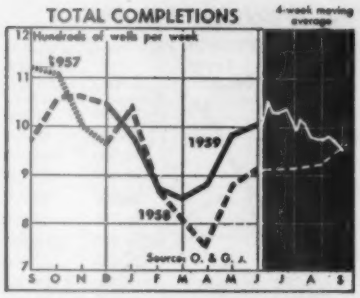
If gasoline consumption is translated to vehicle miles, the gain in highway use from 1946 to 1958 was 94.2%. Total miles of available highway gained only about 5% in the same period.

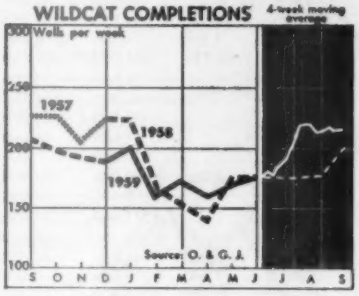
The last chart shows this gain in travel on the average mile of highway. Back in 1946, there were about 103,000 vehicles traveling over the average highway mile during the year. By 1958, the total had climbed to 191,000.

That average mile has been improved, but it is terrifically crowded.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,853,430	UP	26,240	DOWN	245,970
Crude stocks	250,188,000	UP	1,033,000	UP	7,604,000
Completions	945	UP	60	UP	5
Refinery runs	7,722,000	DOWN	272,000	UP	83,000
Gasoline stocks	180,896,000	UP	114,000	UP	7,415,000
Kerosine stocks	32,217,000	DOWN	269,000	UP	1,275,000
Distillate stocks	172,401,000	UP	2,148,000	UP	18,768,000
Residual stocks	59,398,000	UP	1,231,000	DOWN	10,197,000
Four-product stocks	444,912,000	UP	3,224,000	UP	17,261,000
Total imports	1,653,100	UP	261,200	UP	192,800





Active Rotary Rigs

	9-28-59	9-21-59	9-29-58
Alabama	8	8	7
Arkansas	15	17	25
Arizona	2	1	2
California	86	89	73
Land	83	85	(*)
Offshore	3	4	(*)
Colorado	52	61	41
Florida	2	2	1
Land	2	2	1
Offshore	0	0	0
Illinois	45	48	51
Indiana	8	7	10
Iowa	1	2	3
Kansas	139	133	142
Kentucky	8	10	4
Louisiana	326	329	299
North	29	36	27
S. Inland waters	121	123	(†)
S. Land	120	112	235
Offshore	56	58	37
Maryland	0	0	0
Michigan	35	33	10
Mississippi	87	77	51
Missouri	0	0	1
Montana	26	26	23
Nebraska	25	25	21
Nevada	1	1	0
New Mexico	115	112	92
New York	0	0	2
North Dakota	24	26	32
Ohio	5	5	0
Oklahoma	220	223	212
Oregon	0	0	0
Pennsylvania	8	8	9
South Dakota	7	8	3
Texas	764	754	670
S. Inland waters	5	6	(†)
S. Land	193	192	135
Offshore	0	0	1
North-East	176	166	167
West Central	244	247	212
West	146	143	155
Utah	29	30	31
Washington	2	2	1
West Virginia	5	5	2
Wyoming	94	90	63
Total U. S.	2,139	2,132	1,881
Western Canada	181	178	137
Eastern Canada	1	1	4
Grand total	2,321	2,311	2,022

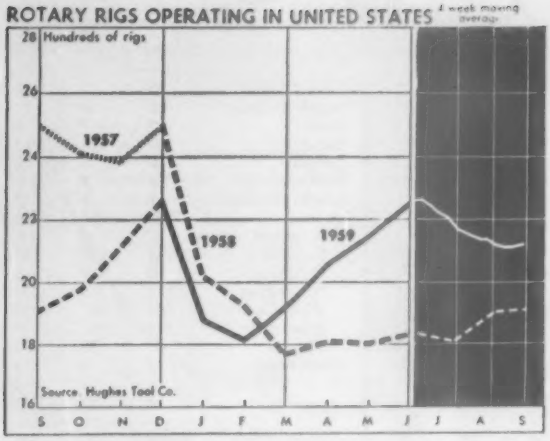
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 26, 1959

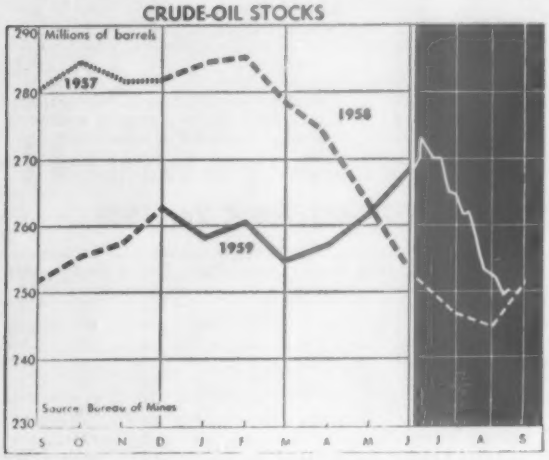
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	5	5	0	0	0	0	57,300	75	58	0	0	0	0	0	20	23
Arkansas	16	7	0	1	8	0	49,776	606	571	3	1	0	0	2	107	121
California	29	17	0	0	12	0	155,965	1,112	1,160	10	1	0	0	9	287	278
Colorado	9	3	0	1	5	0	51,540	564	606	4	1	0	0	3	336	350
Illinois	50	16	0	1	28	5	83,571	1,663	1,643	10	0	0	0	10	284	332
Indiana	33	9	0	0	24	0	44,458	621	578	14	3	0	0	11	212	206
Kansas	62	23	0	2	36	1	226,269	2,950	2,785	24	5	0	1	18	738	587
Kentucky	18	13	0	0	5	0	27,667	1,768	868	5	2	0	0	3	193	114
Louisiana	72	24	8	6	33	1	561,047	2,719	2,546	8	0	0	2	6	367	374
North	30	10	0	6	14	0	121,540	1,045	946	6	0	0	2	4	162	158
South	35	11	7	0	16	1	368,280	1,377	1,274	2	0	0	0	2	191	193
Offshore	7	3	1	0	3	0	71,227	297	326	0	0	0	0	0	14	23
Michigan	16	2	0	0	9	5	53,496	472	304	4	1	0	0	3	120	99
Mississippi	20	8	0	0	12	0	201,802	470	286	5	0	0	0	5	208	133
Montana	7	4	0	0	3	0	45,564	237	249	3	0	0	0	3	75	101
Nebraska	38	6	0	0	32	0	207,989	672	517	23	0	0	0	23	288	243
New Mexico	46	29	0	9	8	0	198,266	1,516	1,439	6	0	0	0	6	176	196
West	16	5	0	8	3	0	55,489	681	694	2	0	0	0	2	47	82
East	30	24	0	1	5	0	142,777	835	745	4	0	0	0	4	129	114
New York	0	0	0	0	0	0	0	195	409	0	0	0	0	0	18	37
North Dakota	7	5	0	0	2	0	47,096	351	335	2	1	0	0	1	67	109
Ohio	23	11	0	3	7	-2	68,910	736	757	0	0	0	0	0	23	12
Oklahoma	126	39	0	6	55	26	370,284	4,187	4,747	21	2	0	2	17	639	653
Pennsylvania	0	0	0	0	0	0	0	392	438	0	0	0	0	0	10	14
Texas	321	160	18	14	118	11	1,381,657	13,914	13,276	56	0	0	0	56	2,622	2,729
District 1	0	0	0	0	0	0	0	780	726	0	0	0	0	0	226	290
District 2	16	2	2	5	7	0	109,628	583	560	2	0	0	0	2	173	149
District 3	28	8	5	0	15	0	198,488	887	950	3	0	0	0	3	180	215
District 4	26	10	3	1	12	0	145,745	992	875	8	0	0	0	8	247	261
East	22	11	6	0	5	0	123,951	906	921	3	0	0	0	3	175	256
District 7-B	68	29	1	2	34	2	213,031	1,917	1,810	15	0	0	0	15	508	510
West	80	58	1	0	17	4	343,439	4,269	3,810	11	0	0	0	11	590	538
District 9	55	27	0	2	21	5	153,791	2,617	2,668	10	0	0	0	10	444	430
District 10	26	15	0	4	7	0	93,584	963	956	4	0	0	0	4	79	80
Utah	11	5	0	0	6	0	55,912	233	283	4	0	0	0	4	62	64
West Virginia	16	1	0	10	3	2	39,993	577	535	1	0	0	0	1	24	13
Wyoming	19	10	0	1	7	1	102,647	727	558	7	2	0	0	5	250	165
Misc. (Alaska)	1	0	0	0	1	0	11,080	103	70	1	0	0	0	1	68	60
Total U. S.	**945**	397	26	54	414	54	4,042,289	36,860	35,018	**211**	19	0	5	187	7,194	7,013
Previous week	885	396	18	78	366	27	3,731,635	....	....	193	8	1	7	177	....	....
Cum. 1959	36,860	18,410	901	2,696	13,872	981	153,529,699	....	....	7,194	668	90	229	6,207	....	....
Cum. 1958	35,018	17,119	852	2,667	13,460	920	144,780,831	....	....	7,013	684	121	201	6,007	....	....
Western Canada	42	20	0	3	14	1	202,282	1,791	1,811	13	1	0	1	11	504	493
Ontario	16	2	0	5	8	1	21,368	186	....	....	....	....	....	....	....	....

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	9-19-59	9-12-59	9-20-58
Pennsylvania	2,659	2,691	2,842
Other Appalachian	2,091	2,033	1,432
Illinois, Indiana, Michigan	9,643	9,455	10,253
Nebraska and North Dakota	2,865	2,668	2,411
Kansas	10,206	10,003	9,171
Oklahoma	13,967	14,769	15,408
Arkansas	2,147	2,001	1,785
Louisiana	18,552	17,768	15,808
North	3,518	3,383	2,722
South	15,034	14,385	13,086
Mississippi, Alabama, Florida	2,576	2,604	2,635
New Mexico	7,687	7,697	7,987
Texas	107,468	106,254	103,344
East Texas	8,963	8,758	7,603
West Texas	49,943	48,471	50,953
Texas Gulf	18,437	18,205	18,889
Other Texas	30,125	30,820	25,899
Wyoming	15,990	15,923	13,108
Other Rocky Mountain	9,298	9,366	9,147
California	29,749	30,219	34,490
Foreign	†15,290	15,704	12,763
Total	**250,188**	249,155	242,584

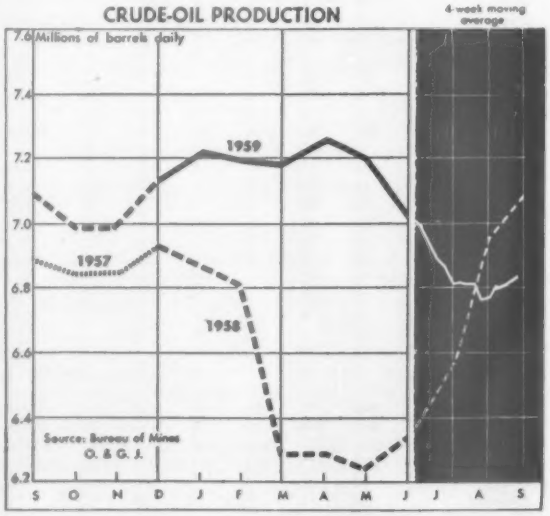
*Bureau of Mines. †Includes 4,847,000 bbl. in California.

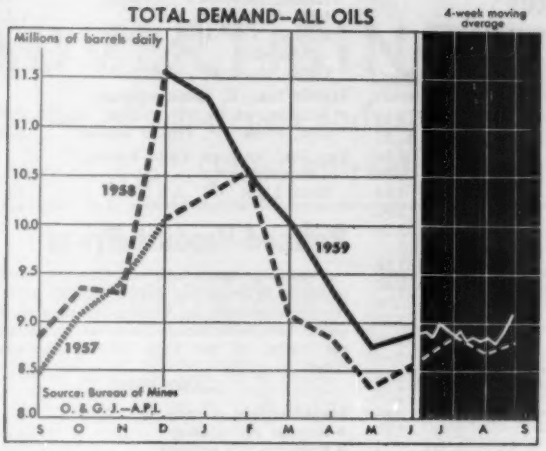
DAILY AVERAGE PRODUCTION FOR WEEK

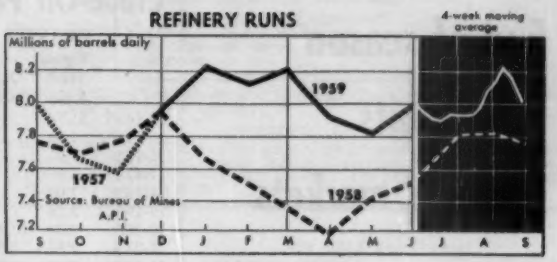
	September 26, 1959 Crude oil	Lease condensate	Total	Sept. 19 total
Alabama	15,600	.....	15,600	15,500
Arkansas	46,250	250	46,500	46,300
California	838,700	.....	838,700	840,200
Colorado	126,600	.....	126,600	126,900
Eastern	40,000	.....	40,000	40,300
Florida	1,200	.....	1,200	1,200
Illinois	219,700	.....	219,700	216,800
Indiana	30,800	.....	30,800	33,100
Kansas	†318,280	.....	†318,280	†315,040
Kentucky	81,600	.....	81,600	81,400
Louisiana	898,900	98,850	997,750	997,850
North	107,900	5,100	113,000	113,100
South	791,000	93,750	884,750	884,750
Michigan	29,500	.....	29,500	29,600
Mississippi	137,800	3,770	141,570	141,570
Montana	82,000	.....	82,000	81,900
Nebraska	65,900	.....	65,900	65,100
Nevada	100	.....	100	100
New Mexico	286,000	4,900	290,900	290,900
North Dakota	50,400	.....	50,400	48,700
Oklahoma	†517,900	.....	†517,900	†498,600
Texas	2,430,000	70,020	2,500,020	2,500,020
Dist. 1	42,000	2,000	44,000	44,000
Dist. 2	103,000	7,600	110,600	110,600
Dist. 3	315,000	35,800	350,800	350,800
Dist. 4	170,000	8,200	178,200	178,200
Dist. 5	28,500	300	28,800	28,800
Dist. 6	105,000	6,200	111,200	111,200
East Texas field	132,500	.....	132,500	132,500
Dist. 7-B	132,500	100	132,600	132,600
Dist. 7-C	115,000	3,020	118,020	118,020
Dist. 8	975,000	4,200	979,200	¤79,200
Dist. 9	202,000	1,600	203,600	203,600
Dist. 10	109,500	1,000	110,500	110,500
Utah	110,800	.....	110,800	111,000
Wyoming	347,300	.....	347,300	344,800
Others	†310	.....	†310	†310
Total U. S.	6,675,640	177,790	**6,853,430**	6,827,190
Change from prev. week up	.....	.....	**26,240**	.....
Canada	†592,000	.....	†592,000	†575,000
Total U. S. Prod.-Jan. 1-Sept. 26				1,901,203,640 bbl.
Same period last year (crude plus cond.)				‡1,773,525,470 bbl.

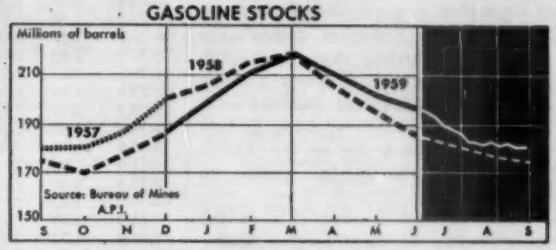
*Includes 42,354,830 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota and Washington.

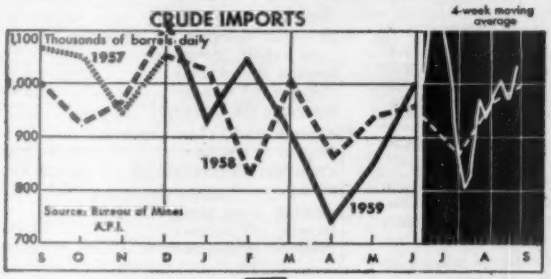
CRUDE-OIL PRODUCTION

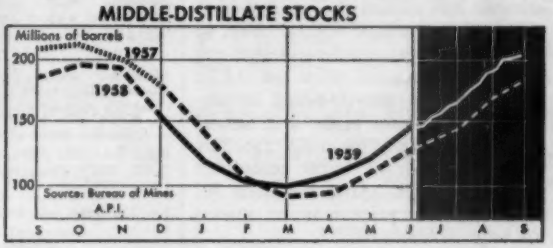


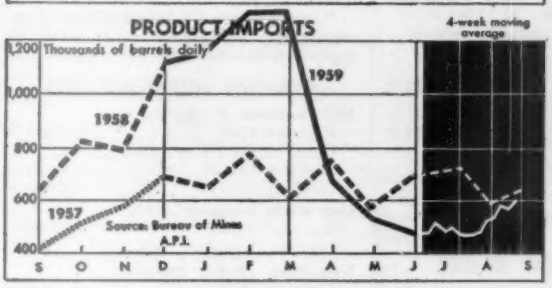


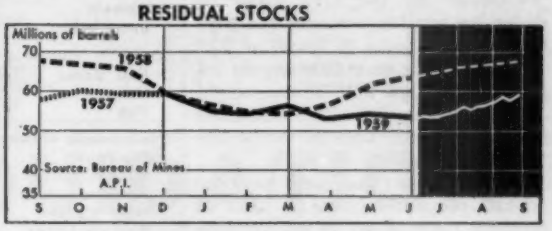












API REFINERY REPORT—SEPTEMBER 25, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September, 1958—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,028	499.8	23.4	303.3	157.0	44,260	13,061	67,664	12,550	1,135	529.4	31.3	313.1	202.0
Appalachian:														
District 1	101	43.9	2.6	23.1	6.6	5,524	640	4,346	393	103	44.6	4.6	21.9	6.8
District 2	86	48.0	8.1	17.3	3.1	2,800	569	1,816	462	96	51.3	5.4	20.7	6.8
Ind., Ill., Ky.	1,383	774.0	64.3	278.3	153.0	31,806	7,580	28,322	6,219	1,387	739.5	59.5	305.2	128.7
Minn., Wis., Dak.	107	46.4	10.6	25.3	13.7	6,442	1,385	7,958	468	76	31.3	1.7	21.8	8.6
Okla., Kans., Mo.	735	405.4	13.8	176.9	26.0	16,871	1,521	12,116	901	704	401.2	12.3	171.4	21.4
Inland Texas	256	205.7	6.3	53.7	21.7	7,245	539	2,012	2,178	270	201.9	11.2	46.8	22.1
Tex. Gulf Coast	1,766	885.4	78.7	469.8	154.3	20,795	3,508	20,644	6,190	1,798	910.1	90.4	470.2	197.9
La. Gulf Coast	708	378.7	63.7	135.6	50.3	9,297	1,593	7,227	1,575	665	383.5	53.5	158.0	46.8
N. La. and Ark.	72	34.6	2.9	14.0	5.0	4,698	1,028	1,938	215	86	36.8	5.8	20.8	6.6
Rocky Mountain:														
New Mexico	23	16.6	0.7	4.1	2.7	798	50	145	41	25	13.1	0.5	4.8	2.4
Other	313	145.6	4.0	64.9	33.9	4,590	366	2,971	1,306	285	130.0	5.6	58.3	30.0
West Coast	1,144	527.0	0	170.1	277.4	25,770	377	15,242	26,900	1,133	504.9	3.0	170.5	293.1
Sept. 25, 1959	7,722	4,011.1	279.1	1,736.4	904.7	180,896	32,217	172,401	59,398	7,763	3,977.6	284.8	1,783.5	973.2
Sept. 18, 1959	7,994	4,170.3	259.6	1,760.9	868.9	180,782	32,486	170,253	58,167	.....	.....	.....	.....	.....
Sept. 26, 1958	7,639	3,965.4	306.1	1,782.1	1,004.9	173,481	30,942	153,633	69,595	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

End-of-season selling hits gasoline markets

GASOLINE prices have drifted lower on the Group 3 market, following a late summer revival that lasted little more than a month. Regular gasoline for northern movement dropped a little under 11.00 cents a gallon in July but climbed back up to the 11.75-12.00-cent range by the middle of August.

Prices started another skid in the early weeks of September. Selling pressure has pushed the general quotation for unbranded regular down to 11.00 cents a gallon. Some sellers are quoting a nominal price of 11.25 cents, but any private-brand or unbranded distributor in the area served by Great Lakes Pipe Line can buy regular gasoline at 11.00 cents plus pipeline charges. And, there are reports that this price may be shaded for large distributors.

Gasoline on the Gulf Coast is under less market pressure, but even here material could be found at 0.25 cent off posting on a firm request for lifting in the last half of the month.

Local reports indicate an increase in gasoline price wars in the Rocky Mountain area.

Refiners report that there has been no late summer increase in sales of distillate fuels to get in on summer-fill programs. Most summer discounts and price guarantees ended at the first of October, but surplus stocks on the Gulf Coast and East Coast will make it difficult for suppliers to raise their net prices this week.

Suppliers on the Gulf Coast are not interested in selling No. 2 distillate for less than 8.125 cents a gallon, at least for October lifting.

But distillate stocks are high in the Gulf-East Coast area, and a warm November could force price reductions at the start of the big heating season.

Residual markets are a little softer in the Group 3 area. On the Gulf Coast, prices are firm despite the loss of summer sales to steel mills.

Natural gasoline . . . With this issue, the Journal resumes reporting of Group 3 natural-gasoline prices. Posting will be listed each week just below quotation for premium gasoline.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill§ Calif.	Okla-homa	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 9-12-59.

§Union Oil Co. of California posting up to 25c less per barrel.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.40
Middle District	4.22
Southwest Pennsylvania	3.95
West Virginia	3.77
Buckeye Grade	3.62
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.00-11.25
★ Premium (99 octane)	13.75-14.00
Natural gasoline (26-70)	4.5
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (98 octane)	12.25
California (rack) (Los Angeles):	
Regular (88 octane)	11.65-12.25
Premium (94 octane)	12.65-13.25
Premium (100 octane)	14.15-14.50
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.00

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.00-9.50
Diesel oil (58 d.i. and above)	8.75-9.25
Distillate No. 1	8.75-9.25
Distillate No. 2	8.00-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.625
Distillate No. 2	8.125
New York Harbor (barges):	
Kerosine 41-43	9.60
Distillate No. 2	9.10
Diesel fuel, 48-52 d.i.	9.40
Caribbean area (cargoes):	
Distillate No. 2	8.125

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.40-1.60
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37-2.47
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Carib.-USNH, dirty (ATRS—52.5%)	$1.31
★ Carib.-UK, dirty (Scale—55%) (14s. 7d.)	2.05
PG-USNH, dirty (USMC—72.5%)	3.49
★ PG-UK, dirty (Scale—57.5%) (26s. 6d.)	3.72

★Denotes change from previous week.

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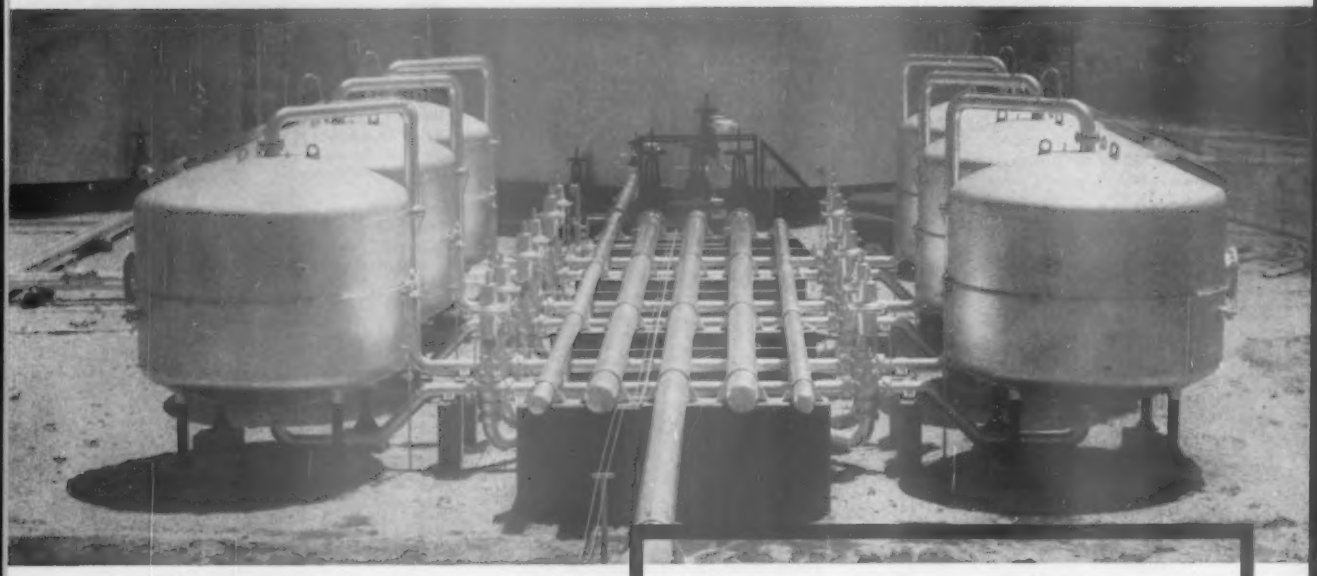

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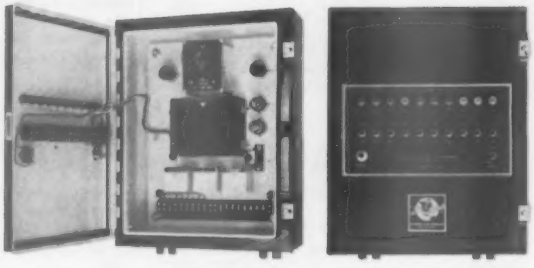

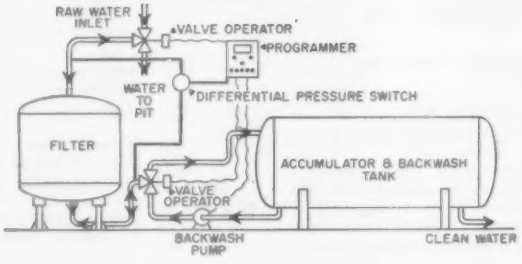

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